

PVP

PAINT and VARNISH PRODUCTION



W. P. Fuller Brawner, President of W. P. Fuller & Co., discusses paint quality based on experimental results with A. P. Pahl (left) Head of Laboratories and Research. (P. 97)



VERSATILE VINYL-ACRYLIC EMULSION FOR EXTERIOR AND INTERIOR PAINTS

RCI 40-124 WALLPOL combines the toughness and adhesion of acrylic ester systems with the demonstrated weather resistance of vinyl acetate copolymers...with an added plus—the sales appeal of the term ‘acrylic,’ but at lower cost.

The result is a versatile vinyl-acrylic which, for the first time, optimizes performance in interior AND exterior coatings: **INTERIOR FLAT PAINTS**—40-124 WALLPOL provides excellent scrubability and color uniformity, improved water spot resistance and good application properties.

EXTERIOR PAINTS—40-124 WALLPOL gives good tint retention, a tighter, more water resistant film and reduces lime “burn out.”

PRIMER SEALER PAINTS—40-124 WALLPOL assures supe-

rior sealing and low temperature coalescence with high gloss of enamel top coat.

For all the details of this efficient new vehicle, write to RCI for Technical Bulletin RE-5.

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Gas chromatography does complex solvent analyses in minutes. Here, a Shell chemist prepares a sample for injection.

BULLETIN:

Shell Chemical announces a monograph describing 31 tests—some standard, some ingeniously devised—to give you greater insight into surface coatings.

Shell uses these 31 tests as a backbone in lacquer formulation. They have led to startling concepts such as *the advantages of solvent retention* and to remarkable new high boiling solvents such as Pent-Oxone* keto-ether and Pent-Oxol* glycol ether.

Read how you can get an indexed, 60-page copy of this monograph telling how to set up these 31 tests, how to run them and *how they can help improve your current formulations*.

THE 31 tests used regularly at Shell Chemical's Technical Service Laboratory in Union, N. J. have led to some fascinating new fields of investigation. One is solvent retention.

A twist on solvent retention

While slow solvent release is known

to cause film shrinkage and have a bad effect on print resistance, *retained solvent* has recently been found to have *good* effects on gloss retention and restoration, cold crack resistance and weatherability.

Test 29 can help you study these dual effects in terms of *what actually happens when lacquer dries*.

Two remarkable new high boilers

Studies of this type led directly to Shell Chemical's two remarkable new high boilers: Pent-Oxone keto-ether, particularly promising in formulations with *dissimilar resins* and Pent-Oxol glycol ether for *maximum blush resistance/practical drying time* in nitrocellulose lacquer formulations.

How to get your monograph

To get your monograph, write or call any of the 9 district offices of Shell's Industrial Chemicals Division. Or

write Shell Chemical Co., 110 W. 51 Street, New York 20, N. Y.

Samples and information

When writing for a copy of the monograph, ask for samples and information on any of these items:

Acetone	Isopropyl Ether
Bisphenol-A	Mesityl Oxide
Diacetone Alcohol	Methyl Amyl Acetate
Di-tertiary-butyl peroxide	Methyl Ethyl Ketone
Ethyl Alcohol	Methyl Isobutyl Carbinol
Ethyl Amyl Ketone	Methyl Isobutyl Ketone
Glycerine	Neosol® Solvent
Hexylene Glycol	Pent-Oxone* Keto-ether
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(REG. U.S. PATENT OFFICE)

FEBRUARY
1961

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NEXT ISSUE

One of the problems with zinc dust paints is the evolution of gas causing containers to leak or burst. Our March issue will carry an informative article describing an approach to the prevention of gas formation in such paints through the use of various additives.

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No other paint emulsion brings you this assurance of outdoor performance. And through this experience in acrylic emulsion testing and applications-development work, Rohm & Haas has amassed a

wealth of practical data. This information is now available to you. Write for *Progress Report No. 7*, a summary of formulating information and outdoor exposure data on RHOPLEX AC-33 paints. Dealer aids and other promotional material are also available, to assist you in marketing paints made with RHOPLEX AC-33.

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EDITORIAL COMMENT

A Trend to Watch

FACTORY-applied finishes of building products are getting more attention these days and the reason for this trend is obvious:—the high cost of applying paints.

Recently, the Stran-Steel Div. of the National Steel Corp. put into operation a highly mechanized and automated production line for color-coating pre-engineered steel building components.

According to Charles Le B. Homer, Stran-Steel's president, this color-coating operation will bring to the market this year the first mass-produced line of pre-engineered steel buildings for which no on-the-job painting will be necessary. He further states that factory applied colors bring the building customer a 300-400 percent saving over the cost of painting in the field during or after erection, plus 10-15 years of decorative-protective durability.

Stran-Steel's new finishing facilities are allocated to the volume production of color-coated roofing and siding panels from continuous coil stock and for color finishing steel building windows and decorative parts.

Factory-applied finishes of building products presents a rather ominous picture to the paint industry as most of the paints used by the building products industry are made by them.

One step in combatting this trend is to develop paints which are easy to apply requiring a minimum of labor.

To some extent this has been done with latex paints where they have been used successfully in architectural applications. However, in the field of structural steel, much has to be done. It is in this area that new types of coatings as well as better application methods which will help reduce labor costs must be developed.

Scientific Output

IN the research race with Russia, one good secretary is worth at least two good scientists.

This is the opinion of Robert Sommer of the Saskatchewan Hospital, Weyburn, Canada.

In a recent issue of the *Worm Runner's Digest*, an informal journal of the University of Michigan Department of Psychology's Planaria Research Group, Sommer observed:—

"It is axiomatic that a lab can produce only as fast as its secretary can type. The lab with one scientist and four secretaries is in a more favorable position than the lab with four scientists and one secretary.

"In the latter case, the scientist will spend most of his day peering over the secretary's shoulder seeing whether she is showing favoritism to his three colleagues. There will be intrigues and quarrels to get letters typed, income tax forms filled out, and lead pencils requisitioned.

"In the lab with one scientist and four secretaries our man is in constant turmoil to keep his assistants busy. He feels he must produce so that his harem looks busy. If they start bringing in knitting and learning bridge, his superiors will become suspicious."

According to Sommers, the scientific output of any research laboratory can be reduced to this simple formula:

$$\text{Productivity} = \frac{\text{No. of Secretaries} \times \text{Typing Speed}}{\text{Number of Scientists}}$$

How well does this formula apply in your lab? Incidentally, as the number of scientists approaches zero, productivity will zoom to ad-infinitum. But as Sommer concludes this is probably true, but has never been tested empirically.

New Eastman high-flow retarder solvent offers lacquer formulators 4 important advantages

Higher Solids Content
Better Flowout and Leveling
Lower NC Solution Viscosities with Toluene
Blush Control with Good Solvent Release

Methyl isoamyl ketone (MIAK) is a new high-boiling solvent with remarkably high solvency for nitrocellulose, cellulose acetate butyrate, acrylics and vinyl copolymers. Its unusual solvent power permits you to formulate high solids lacquers that exhibit superior flowout and leveling. Its solvency is greater even than that of n-butyl acetate. (See table at right)

MIAK has a high toluene dilution ratio (4.1). Of even greater significance, however, is the low viscosity of MIAK/toluene-nitrocellulose solutions. As the graph at right indicates, the viscosity of such solutions is lower than that of 2-ethoxyethyl acetate/toluene or even methyl iso-butyl ketone/toluene solutions.

With an evaporation rate of 0.55, MIAK is slow enough to provide excellent blush control, yet not so slow as to delay sanding and rubbing operations.

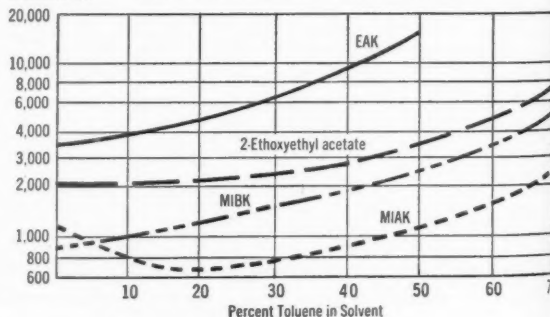
Another point, MIAK has a mild ester-like odor, much more pleasant than the characteristic odor of the higher ketone solvents.

Investigate this new high-flow, retarder solvent in your formulations. Its cost per gallon is competitive with most other retarder-type solvents. Write for a sample of methyl isoamyl ketone and Technical Data Sheet M-105.

**Comparison of Solvent Power
of MIAK with Other Solvents**
Viscosity, cps. @ 25° C.

Solvent	Evaporation Rate	10% 1/2 Sec.R.S. Nitrocellulose	10% Half-Second Butyrate	20% Acryloid B-82 Resin	20% VYHN Copolymer
MIBK	1.6	30	23	15	138
n-Butyl Acetate	1.0	44	36	26	GEL
MIAK	0.55	44	33	21	168
Ethyl Amyl Ketone	0.3	86	Ins.	28	286
2-Ethoxyethyl Acetate	0.2	122	68	50	Ins.

**Effect of Toluene on the Viscosity of
20% R. S. 1/2 Sec. Nitrocellulose Solutions**
Viscosity, 25°C.,
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PUBLISHER
 JOHN POWELL

EDITOR
 ANTHONY ERRICO

EDITORIAL STAFF
 Marvin C. Feinstein,
Assistant Editor
 J. P. Danforth, *Art Editor*
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 Vladimir Slamecka, *Foreign*
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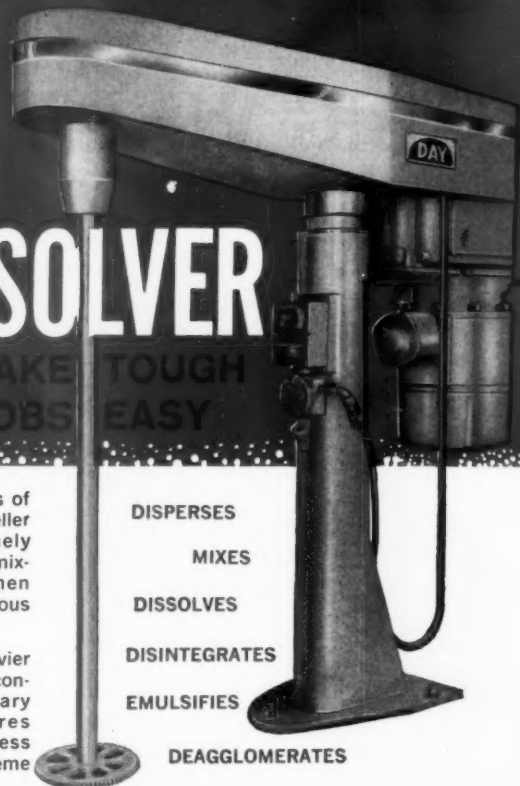
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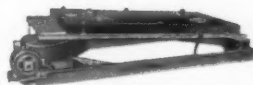
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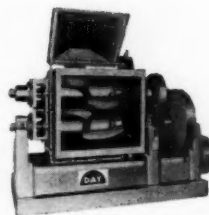


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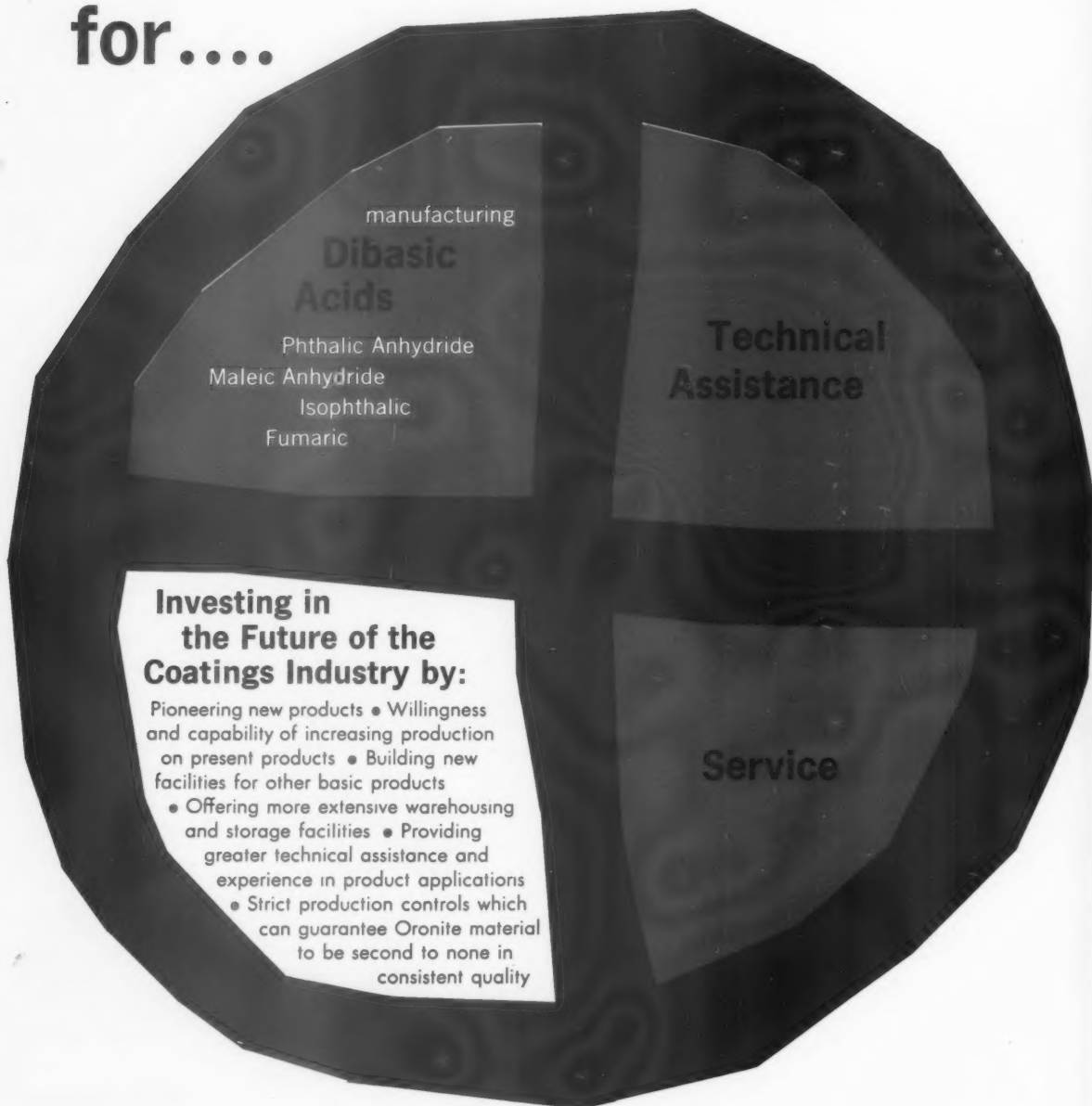


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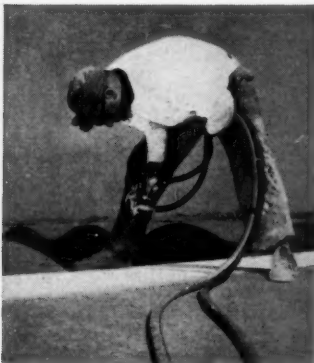
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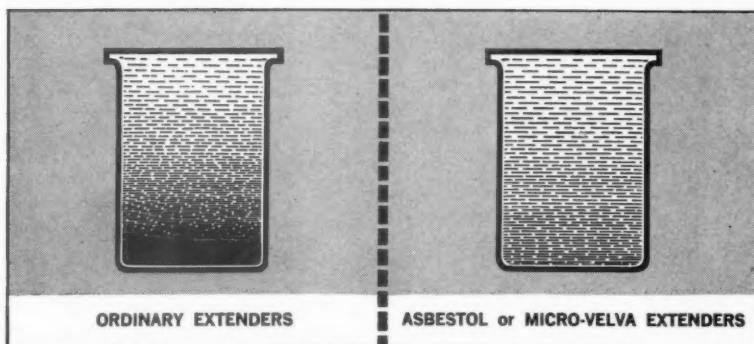
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2. A formulation with a 10% replacement of the original vehicle with Velsicol W-617 resin.
3. A formulation with a 25% replacement of the original vehicle with Velsicol W-617 resin.

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**PROGRESS
REPORT ON
MEDIUM OIL
ISOPHTHALIC
ALKYD
IB-1550**

SPECIFICATIONS

Solids.....	50± 1%
Viscosity.....	V—X
Solvent.....	Mineral Spirits
Viscosity at 40%.....	D-G
Color.....	7 Max.
Acid Value.....	5 Max.

DEVELOPMENT ■ IB-1550 was developed for application where fast dry, hardness, good color and color retention, good gloss and gloss retention and excellent flow properties are desirable. ■ A comparison of white enamels based on IB-1550 and medium and long soya pthalic alkyds shows IB-1550 excels in dry, gloss, gloss retention, yellowing and application proportions. In addition, IB-1550 formulations are free of haze, so often a problem with conventional alkyd enamels. ■ IB-1550 gloss and semigloss formulations avoid the use of lead driers and substitute Zirco-Cobalt-Manganese drier systems to get faster dry and better gloss and color. ■ Note in the specifications above that IB-1550 has a relatively slow viscosity reduction—important where final cost is a consideration. ■ Possible Applications: IB-1550 is extremely versatile and its high gloss and semigloss characteristics suggest use in trade sales enamels. Speed of dry and gloss are highly suited for air dry and low bake industrial finishes, implement enamels, auto refinishing, etc. Outstanding flow and excellent gloss and color suggest use in roller coating applications.

Samples, formulations and test procedure reports on IB-1550 medium oil isophthalic alkyd are available by writing to Cargill,

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EPOXY ESTER COATINGS upgraded by dimer acid

Substitution of Empol 1022 Dimer Acid for a portion of the fatty acid modifier in epoxy ester coatings improves viscosity, caustic resistance, water resistance, through-dry, hardness, color retention, and flexibility. As an example, the table at the right shows the degree of improvement obtained in a test formulation made with a high I.V. liquid vegetable fatty acid. Formulations based on other proportions and other fatty acids should respond similarly.

This use in epoxy ester coatings is but one application of Empol 1022 Dimer Acid in the Surface Coatings Industry. Its unique composition (a mixture of 75% C₃₆ dibasic and 22% C₅₄ tribasic long-chain acids) makes it an unusually interesting material in many types of surface coatings. For product data and an experimental sample, write Dept. X-2



ORGANIC CHEMICALS DIVISION,
Emery Industries, Inc.
Carew Tower, Cincinnati 2, Ohio

The extent to which 1022 can achieve improvements
in one epoxy ester coating is shown below:

COMPOSITION

	50 parts	50 parts
Epi-Rez ¹ 530	50	44.5
Emersol ² 9315 D.D. Liquid F.A. ³	0	5.5
Empol ⁴ 1022 Dimer Acid	60	60
% Solids	Xylene	Xylene
Solvent	N	X-Y
Viscosity, Gardner-Holdt	1.4	3.7
Acid Value	4	6
Color, Gardner		

AIR DRY, SAND TRAIL METHOD (0.03 Co, 0.3 Pb as naphthenate dryers)

(adherence of sand
due to lack of through-dry)

	tacky	tack-free
3 hrs.	sl. tacky	tack-free
8 hrs.		
SWORD HARDNESS		
2 days	2	2
1 week	6	8
2 weeks	13	16
4 weeks	22	27

CHEMICAL RESISTANCE PROPERTIES

Boiling 2% NaOH, 1 hr.	badly broken	sl. broken
Boiling Water		
1 hr.	sl. loss adhesion	unchanged
2 hrs.	pimples	pimples
4 hrs.	darkened, broken	darkened, not broken
2% Tide ⁴ , 160°F, 4 hrs.	lifted badly	lifted badly

5 DAY ULTRA VIOLET EXPOSURE OF PAINTS

Change in yellowing index (Larger value indicates more yellowing)	8.6	3.9
Impact resistance after exposure (Gardner variable impact, inch-lbs)		
Concave	>160	>160
Convex	110	140

¹T.M. Jones-Dabney Company

²T.M. Emery Industries, Inc.

³Emery Industries, Inc., Fatty Acid Division; I.V. 145-160

⁴T.M. Procter & Gamble Company

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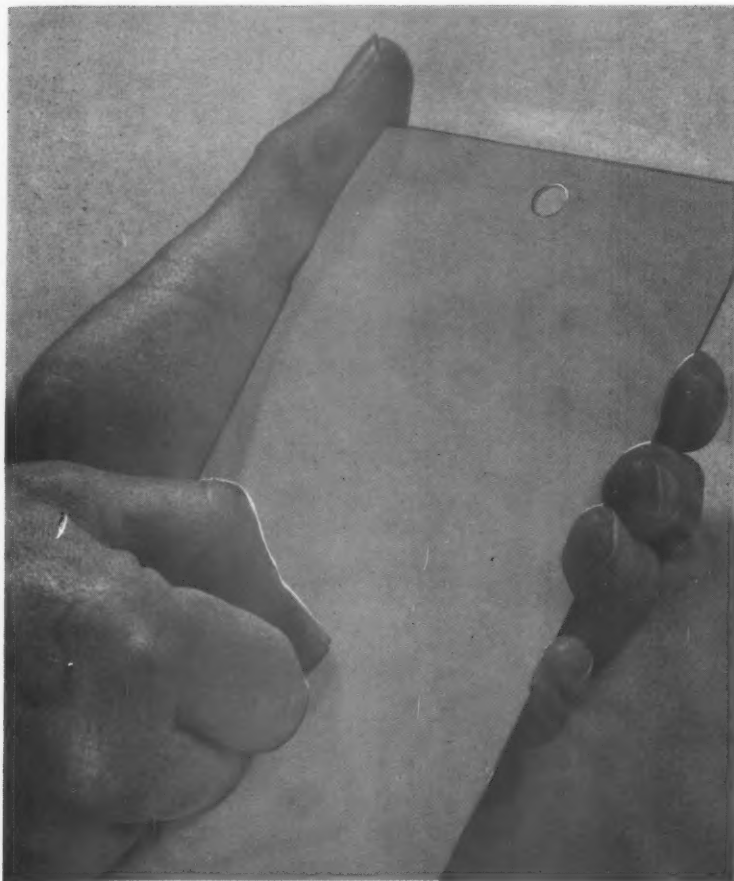
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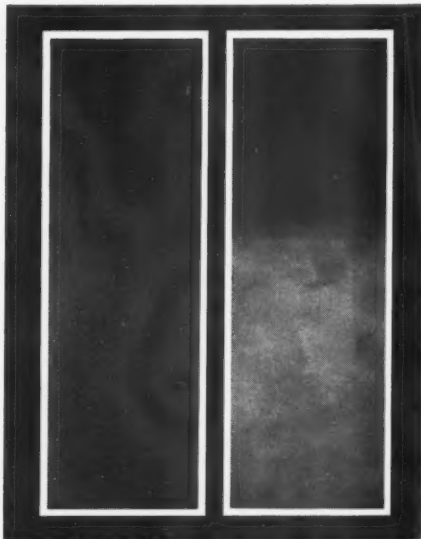
Another plus: as with many paints based on Dow Corning Silicones, this new resin can be formulated into a full range of colors. In product finishes, such silicone paints provide more durability as well as heat resistance where needed.

The "proof is in the painting". Why not try your own thumb nail test on a paint based on this new Dow Corning silicone resin? For full technical information contact the nearest Dow Corning office or write directly to Dept. 6514



Paint based on new Dow Corning resin takes a 180° bend on a 1/4" mandrel without crazing, checking, or peeling.

Panels exposed for one year in industrial location. Note how organic paint (right) has faded and chalked while silicone finish is unaffected.



New Silicone Paint Bakes At 350 F; Has Exceptional Weather Resistance

One of the newest Dow Corning resins formulates into a coating that's a real "toughie". It outlasts every good organic we test it against in Florida, retaining full color and gloss. In high temperature aging tests, paints based on this new resin withstand continuous 450 F without discoloring. In addition, this toughest of all silicone paint resin compares well with conventional resins for flexibility and adhesion.

Processing is simplified, too, with this new resin. Good film properties are obtained by curing the coating in temperatures ranging from 350 to 600 F, by adjusting exposure time.

Weathering — punishing snow, rain, sun, salt spray — has no harmful effects, either. Paints based on this new resin outlast 'em, sealing destruction away. Aluminum siding, hardware and some outside appliances are a few applications where such a paint would be advantageous.

For more detailed information or specific technical data on silicones for paint formulation, write us today.



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THE MECHANICAL PROPERTIES of PAINT and VARNISH FILMS

By
Dr. H. W. Talen*

A MOST important aspect of the evaluation of paints and varnishes is the determination of the time that a paint film can be expected to maintain its protective function which, of course, should be as long as possible.

It is therefore quite useful to probe into the causes of failure which may be divided into chemical and physical-mechanical causes which may act simultaneously.

Chemical agents for degrading paint films externally under atmospheric conditions are oxygen, water, ozone and occasionally other gases, e.g. sulfur dioxide in industrial environments.

Internal failure by chemical reaction may result from interaction between film components, such as pigment and vehicle.

Physical-mechanical failure may result from high or low temperature, fluctuations in temperature, irradiation by radiant energy. One of the first conditions for effective protection is that the film remains intact and does not break by the formation of cracks or fissures.

Once cracking starts, the film breaks up into small pieces, which cannot give adequate protection, even if the separate fragments remain in their places.

The problem of cracking is fundamentally one of "ultimate" properties, viz. tensile strength and elongation at break.

The elongation at break is a particularly important property, because very often the deformations of a paint film on a substrate, e.g. wood, are forced by changes in the substrate, and no strengths however great, can prevent the breaking of a very thin paint-layer, if its deformation surpasses the elongation at break.

Among earlier authors who have studied changes in mechanical properties, reference is made to the work of *Elm* (1), *Alfrey* (2), *Brunt* (3). Also among earlier

A most important aspect of the evaluation of paints and varnishes is the determination of the time that a paint film can be expected to maintain its protective function.

The performance of several varnish and paint compositions was examined by outdoor tests, and by tensile tests of the detached films.

Varnish films based on standoil and on alkyd resins with and without the addition of "hard resins", were exposed on wooden panels on test fences.

Films applied on tinfoil of the same varnishes were stored indoors, exposed outdoors on test fences, radiated by carbon arc lamps, immersed in water and exposed in an accelerated weathering apparatus.

Periodically tensile tests with the detached films were made giving the stress-strain curve and the tensile strength, elongation at break and modulus.

Paints with white pigments were investigated in a similar way. Besides outdoor exposure tests on wood, films on tinfoil were stored indoors, exposed on test fences, submitted to a humidity test and exposed in an accelerated weathering apparatus. Periodically tensile tests of the detached films were made.

By this method of testing, the effects of radiation, humidity and atmospheric conditions on the varnish and paint films clearly became manifest, generally in much shorter time than with conventional outdoor exposure tests.

investigations in this field are *Nelson* (4), *Dunn and Baier* (5), *Elm* (6), *Grinsfelder* (7), *Snoddon and Carrick* (8) and *Bosch c.s.* (9).

It is not deemed necessary to go further into these publications here. However, *Dr. J. S. Long* (10), may be quoted here: "— we have reached a point when it would seem desirable to build up data on the mechanical strength properties of films, especially data pertaining to tensile strength, elongation and bonding power to various surfaces. With such data available, the paint technician will be better able to build his protective coatings to resist the naturally occurring forces of film destruction".

Previous Investigations

In 1948 *Dr. F. J. Hermann* started an investigation into the mechanical properties of red lead-linseed oil paints in comparison with red iron oxide-linseed oil paints. One of the purposes was to look into the

*Paint Research Institute T. N. O., Rijswijk Z. H., Netherlands

influence of the PbO content of different types of red lead, and in comparison therewith paints were examined, containing lead oxide (as litharge) and iron oxide as pigments. The results were analysed statistically and showed satisfactory reproducibility. (11).

The main results of this research are summarized in a paper read at the Scarborough Conference 1951 of the Oil and Colour Chemists' Association (12), together with the results of similar tests made with stand oil and alkyd paints with white pigments. Data of stand oil and alkyd paints with lead titanate, zinc oxide, anatase titanium dioxide and several types of rutile titanium dioxide were given.

The paints were exposed outdoors on wooden panels and films on tinfoil were stored in an air-conditioned room at 20° C and 65% relative humidity, and submitted to tensile tests after different periods of time.

At the F.A.T.I.P.E.C. congress at Noordwijk (Holland) 1953 (13) more experiments with pigmented standoil and alkyd paints were reported. In this congress publication, the results of tensile tests were compared with those of other, more conventional, paint tests, such as Erichsen and bend tests, scratch tests, etc.

Comparisons were also made with the results of outdoor exposure tests of the same paints applied on wooden panels.

The following general conclusions were drawn:

1. Tensile tests on detached paint films stored indoors revealed differences in the mechanical properties and their changes with time, not revealed by other, more conventional methods.
2. Although it is obvious that outdoor weathering properties cannot be deduced exclusively from the changes in properties during storing the film indoors, some interesting parallels have been obtained; for instance, between elongation at break and the formation of cracks outdoors.
3. All the alkyd paint films had a much higher tensile strength than the corresponding stand-oil paint films.
4. Tensile tests may be used to give an insight into the "reactivity" between the pigment and the vehicle in the dry film and into the effect of this reactivity on the durability.
5. Films of the alkyd-zinc oxide paint were very rigid after some months storage indoors; the alkyd-lead titanate and the alkyd-titanium dioxide paint films had much lower moduli.
6. The difference in modulus between the alkyd paints with rutile-titanium dioxide (non chalking quality) and anatase-titanium dioxide might be connected with the good resistance to chalking of this particular rutile type and the severe chalking of the anatase type.
7. With the stand oil medium the differences between the various paints were less striking. The paints containing zinc oxide developed a greater film modulus than those with lead titanate or with titanium dioxide pigments, but the phenomena did not show such marked differences as with the alkyd paints.
8. In the case of the paints tested, an acceleration

of the changes in properties was observed by raising the film storage temperature from 20° C to 40° C, the types of behavior not being greatly modified.

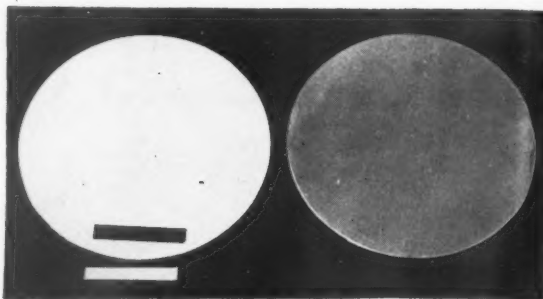


Figure 1. Glass discs with tinfoil and painted—test strip cutout.

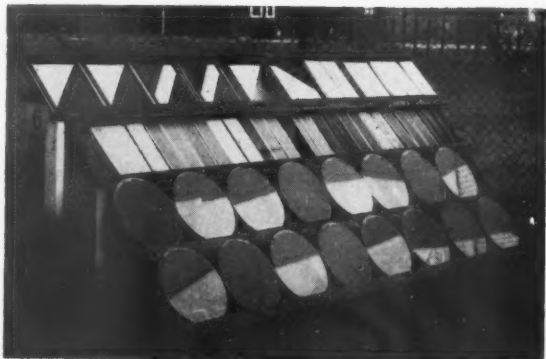


Figure 2. Films on tinfoil exposed to the atmosphere.



Figure 3. Hoekstra dynamometer.

In publications (14) and (15) relations were established between the results of practical service tests on a block of apartment houses, of test panels exposed to the weather, facing South at 45° to the horizon and of laboratory tests.

The examples presented showed that, even in the case of films kept indoors at a constant temperature and humidity, the mechanical properties, as revealed by tensile tests, may change in such a way that the formation in practice of cracks, followed by scaling, may be explained.

It is these "intrinsic" characteristics which to a large extent predetermine the behavior of the film in practice.

Having gained a knowledge of the intrinsic properties and changes on aging, it is necessary to study the influences of atmospheric agents such as radiation and humidity on the mechanical properties of films.

Some preliminary experiments with unpigmented varnishes and determinations of the mechanical properties of varnish films after extraction of the low molecular weight components by acetone were also described (16).

Scope of the Investigations

For the purpose of classification, the films included in the present paper may be grouped under *unpigmented films* (varnishes) and *pigmented films* (paints). *Unpigmented Films* (varnishes).

The influence of the addition of "hard" resins to stand oil and alkyd media was investigated by outdoor exposure tests. A definite deteriorating effect of about 15% of most of the hard resins tested was shown.

Tensile tests were made on films stored indoors, exposed outdoors on test fences, irradiated by carbon arc lamps, immersed in water and exposed in an accelerated weathering apparatus.

Pigmented Films (paints).

The influence of outdoor weathering on the mechanical properties of some white paints was examined, in comparison with the influence of indoor storage under constant conditions.

The changes in mechanical properties during exposure in an humidity cabinet (45° C and 100% rel. humidity) and in an accelerated weathering apparatus were investigated as well.

Tensile Tests

The films to be tested were prepared by spinning the liquid paints on rotating glass discs covered with tinfoil. After drying and hardening the films for two weeks at 20° C and 65% rel. humidity, a test series starts with the cutting out of strips, followed by the dissolution of the tinfoil in mercury, leaving the films detached. (Fig. 1 and 2).

The tensile tests were made with a Hoekstra dynamometer (Fig. 3) giving a record of the stress-strain curve, from which the following figures are of special interest:

—tensile strength in g/mm²;—modulus at 5% elongation in g/mm²; giving an indication of the rigidity at small deformations;—elongation at break in percentage of the original length of the test strip.

The rate of traction was fixed at 7, 3 mm per minute. All tensile tests were made in an air-conditioned room, at 20° C and 65% relative humidity.

UNPIGMENTED FILMS (VARNISHES)

An investigation was undertaken into the influence of the addition of several "hard" resins to stand oil and alkyd media on the outdoor durability of these varnishes.

The basic media were a linseed oil—tung oil—stand oil (2:1) and a drying oil-glycerol-alkyd with 30% phthalic anhydride. The drier used in all cases was lead-manganese-cobalt naphthenate, and the thinner was white spirit.

The standoil and the alkyd media were examined as such, and with the additions of 5, 10 and 15% (calculated on the non-volatile part by weight) resins of different types.

The compositions of the varnishes dealt with in this paper are summarized in Table 1. With these varnishes the following experiments were made:

Code	Composition	Time of exposure in months			
		10	15	18	24
0-0-0	linseed-tung-stand oil (2:1)	0	0	0	2
0-1-15	" 15% rosin (colophony) W.W.	1	3	3	7
0-7-5	" 5% modified phenolic resin (melting range 135-156°C)	0	0	1	6
0-7-10	" 10% modified phenolic resin	0	1	2	6
0-7-15	" 15% modified phenolic resin	1	1	2	6
0-17-15	" 15% poly-olefine resin	1	2	3	7
0-19-15	" 15% cyclohexanone resin	0	1	2	7
0-20-15	" 15% alkyl-phenolic (100% phenolic) resin	0	0	0	1
P-0-0	alkyd resin, 30% p.a.	0	0	0	2
P-1-15	" 15% rosin (colophony) W.W.	1	4	4	7
P-7-5	" 5% modified phenolic resin (melting range 135-156°C)	0	0	0	2
P-7-10	" 10% modified phenolic resin	0	0	2	7
P-7-15	" 15% modified phenolic resin	1	3	5	7
P-17-15	" 15% poly-olefine resin	2	3	6	7
P-19-15	" 15% cyclohexanon resin	0	1	3	6

Legend: 0=intact, 1-7=scale of increasing crack formation and deterioration.

Table 1. Summary of varnishes investigated.

1. Conventional exposure tests on wooden panels at test fences. Observation of cracking etc. made at appropriate intervals.
2. Films stored at 20° C and 65% rel. humidity. Tensile tests made at 1/2, 1, 3, 6, 12 and 18 months after application of the varnishes.
3. Films, applied on tinfoil-covered glass plates, exposed at the test-fence, after a drying and hardening indoors for two weeks. Tensile tests made after 1/2, 1, 3, 6 months exposure outdoors.
4. Films on tinfoil, exposed to the radiation of carbon arc lamps, after a drying and hardening in air-conditioned room for 2 weeks. Tensile tests made after appropriate intervals.
5. Tensile tests on films after immersion in water and subsequent drying out in air-conditioned room.
6. Tensile tests on films exposed to accelerated weathering (radiation and water spray) and subsequent reconditioning in air-conditioned room.

Results of Exposure Tests

The results of the exposure tests, in respect of cracking are summarized in Table 1. The pure standoil film 0-0-0 remained intact for 18 months and showed some cracking after 24 months of exposure.

The 100% phenolic stand oil varnish 0-20-15 remained in a very good condition.

All other varnishes with 15% hard resin showed cracks after exposure during various periods of time.

The pure alkyd varnish P-0-0 remained intact for 18 months and showed some cracking after 24 months.

The addition of 15% hard resin caused cracking after 10 months, with the exception of the varnish P-19-15, which began to crack after 15 months.

In the series 0-7-5, 0-7-10 and 0-7-15, respectively P-7-5, P-7-10 and P-7-15 the influence of the increasing amount of hard resin was clearly shown.

Results of Tensile Tests

Films Stored Indoors at 20° C and 65% R.H.

The results of the tensile tests are shown graphically in Figs. 4 through 13. These results give rise to the following conclusions about film properties:

The *alkyd resin varnishes* had a much greater tensile strength (sometimes as much as ten-fold) than the corresponding stand oil and oleoresinous varnishes.

The alkyd varnishes had a greater modulus at 5% elongation than the corresponding oleoresinous varnishes. The elongation at break of the alkyd varnishes was a little greater than that of the oleoresinous varnishes.

The *oil based varnishes* showed generally a *regression* of the modulus with the storage time, the films getting weaker and softer during aging indoors. Even by finger touch some tackiness could be detected after aging.

The influence of an addition of 5% hard resin was small; an addition of 15% hard resin gave no decrease of elongation at break, but a stiffening effect as revealed by the modulus, which however decreased with time.

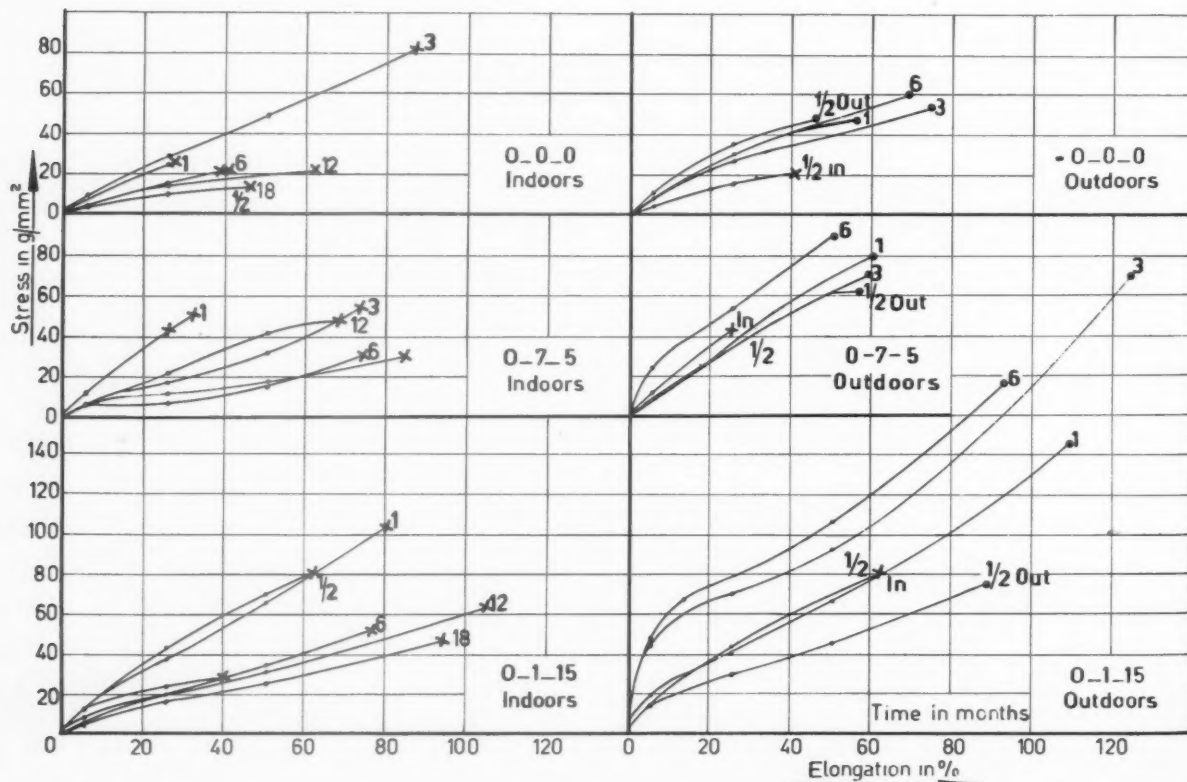


Figure 4. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnishes 0-0-0, 0-1-15, 0-7-5.

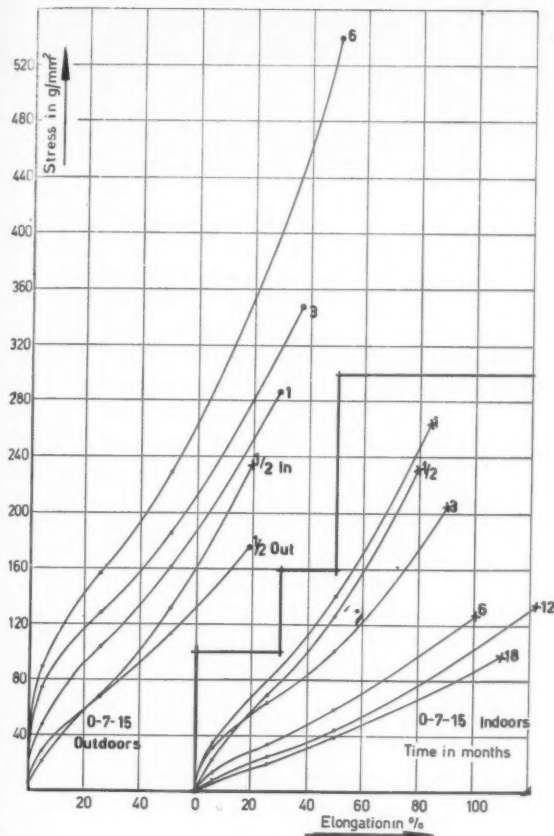


Figure 5. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish 0-7-15.

On the other hand, the *alkyd* varnishes showed an increase in modulus with aging time indoors: an aging process more as expected. The addition of 5% hard resin had no great effect on the tensile properties.

The addition of 15% hard resin had a stiffening effect, which increased with aging indoors.

Here specific influences of the type of resin appeared, as shown clearly with resin No. 17. Varnish P-17-15 lost its distensibility during storage indoors for some months. From this result it might be predicted that this composition would not be very successful in practice, as was confirmed in the outdoor exposure tests and the other experiments dealt with below.

Films Exposed to Weathering

The varnish films on glass plates covered with tinfoil were exposed after two weeks drying and hardening at 20° C and 65% rel. humidity indoors on the test fence facing South at 45°.

The results of the tensile tests made after 1/2, 1, 3 and 6 months are shown in Figs. 4 through 13. Here an important difference between the oleoresinous and the alkyd varnishes appears.

On the whole the *oleoresinous* varnishes showed no deterioration in properties during this period of aging outdoors. In several cases the tensile strength and the elongation at break were even increasing slightly.

The moduli of several oleoresinous varnishes had in contrast to the behavior indoors, a tendency to in-

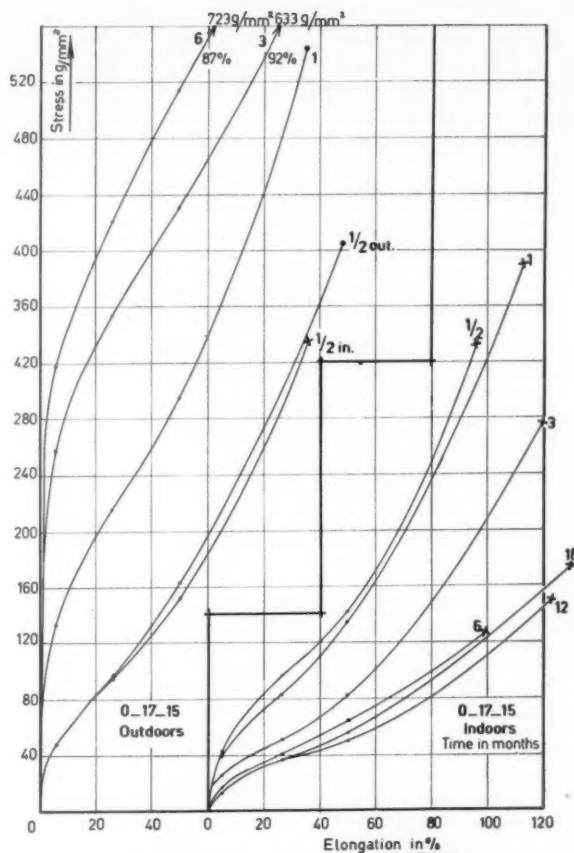


Figure 6. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish 0-17-15.

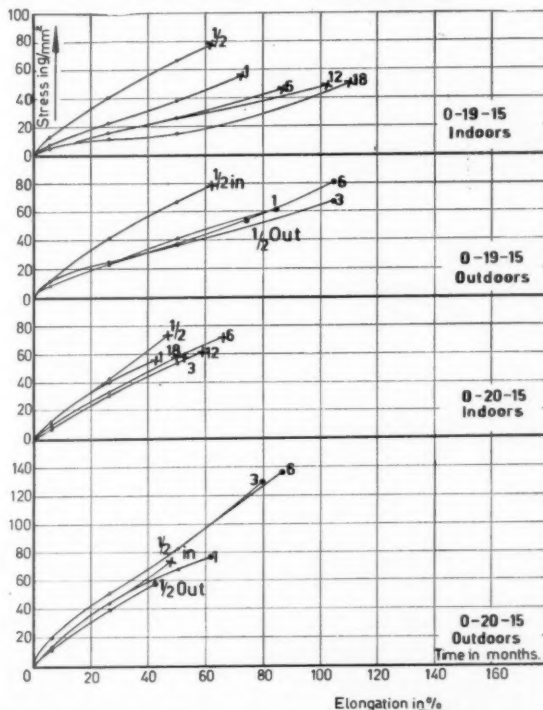


Figure 7. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnishes 0-19-15 and 0-20-15.

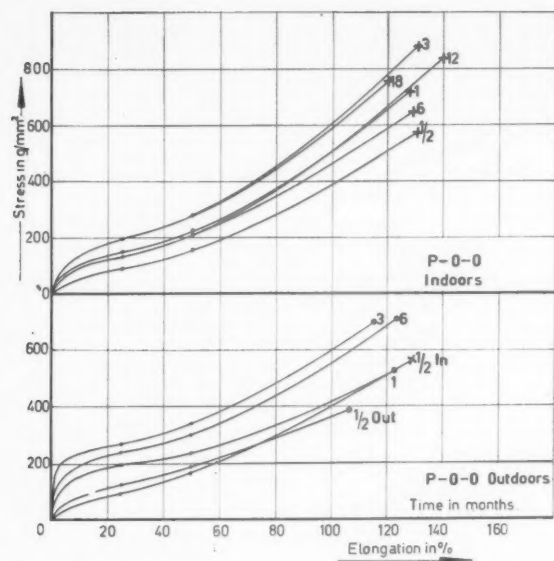


Figure 8. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish P-0-0.

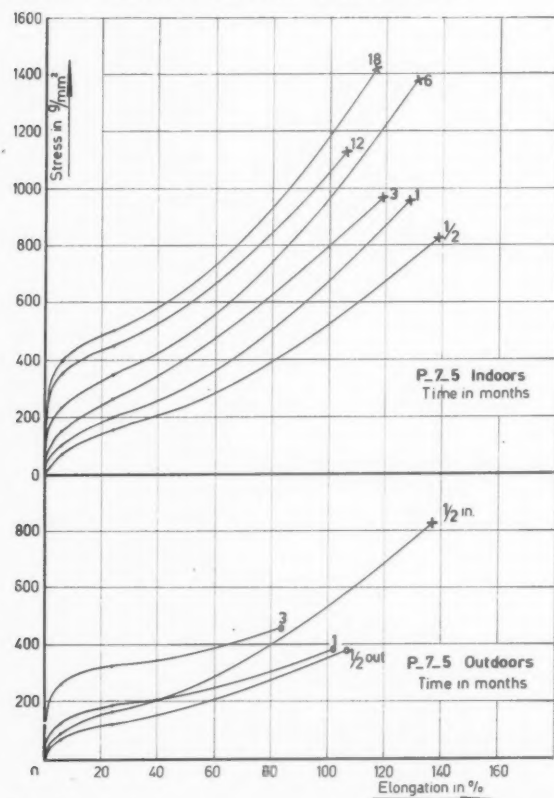


Figure 10. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish P-7-5.

crease with aging outdoors. This was particularly clearly shown by the varnish with resin No. 17 (Varnish 0-17-15), which resin was already conspicuous by its behavior in the indoors stored alkyd varnish.

On the other hand the alkyd varnishes showed clearly the influences of the addition of hard resins on the outdoor durability. The pure alkyd varnish

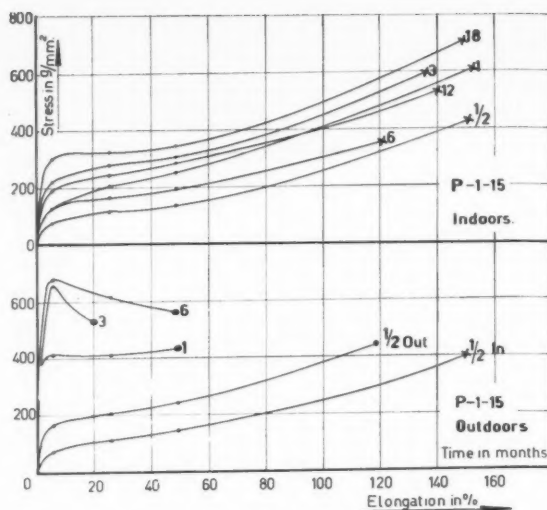


Figure 9. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish P-1-15.

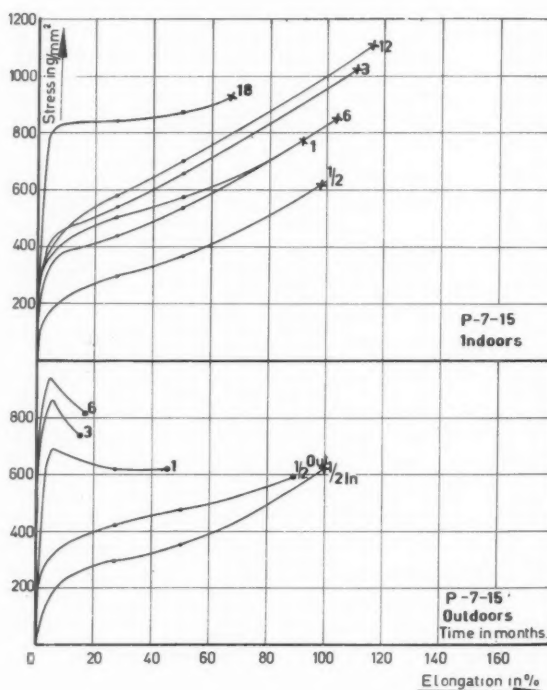


Figure 11. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish P-7-15.

P-0-0, although increasing in film modulus, showed no decrease in tensile strength nor in elongation at break.

With addition of hard resins, the modulus generally increased, whereas the elongation at break decreased with aging in relation to the quantity and the type of the resin added. The deteriorating effect of resin No. 17 in varnish P-17-15 in this experiment was also quite marked.

Films Exposed to Radiation of Carbon Arc Lamps

Films on tinfoil, after drying at 20° C and 65% rel. humidity, were exposed to the radiation of two

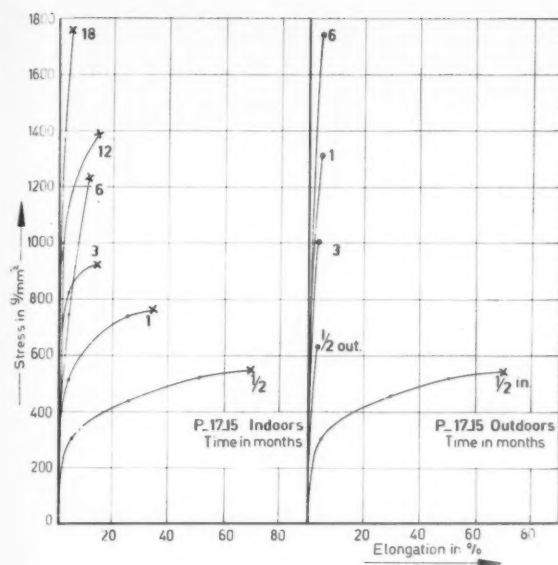


Figure 12. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish P-17-15.

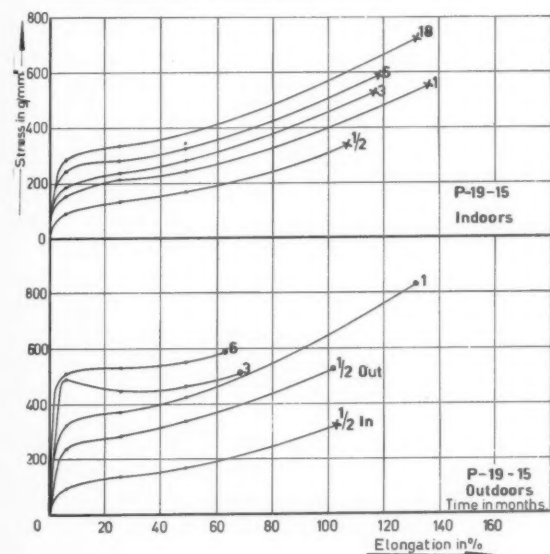


Figure 13. Stress-strain curves of varnish films stored indoors and exposed outdoors. Varnish P-19-15.

carbon arc lamps of the accelerated weathering apparatus.

During the radiation the films were cooled by a stream of cold air. The radiation was continuous during 80 hours, after which the films were reconditioned at 20° C and 65% rel. humidity for several days.

The results of the tensile tests of the radiated and the non-radiated films are shown in Table 2.

As with the outdoor tests, a difference between the oleoresinous varnishes and the alkyds has been found. The oil-based varnishes did not show appreciable effects of the radiation during 80 hours. On the other hand, the influence of the hard resin additions to the alkyd medium was manifest, especially with regard to the changes in modulus and elongation at break.

Varnish No.	Tensile gm/mm ²	Modulus gm/mm ²	Elong. %
0-0-0	35 (*)	12	32
	59	12	43
0-1-15	49	9	75
	62	9	85
0-7-5	68	13	58
	84	28	70
0-7-10	86	20	54
	86	26	72
0-7-15	206	27	71
	312	53	84
0-17-15	242	43	90
	231	69	68
0-19-15	62	9	70
	53	9	83
0-20-15	49	11	48
	86	15	57

P-0-0	310	50	101
	890	230	114
P-1-15	365	125	145
	650	690	40
P-7-5	262	54	100
	635	220	110
P-7-10	800	152	114
	880	470	82
P-7-15	800	430	80
	1440	1600	25
P-17-15	1080	990	77
	too brittle to measure		
P-19-15	430	155	131
	1070	970	88

Table 2. Mechanical properties vs. carbon arc radiation* on varnishes.

*The first figure for each varnish is for non-irradiated film, the second was irradiated for approx. 80 hours.

Films After Immersion in Water

After a period of drying at 20° C and 65% rel. humidity, the detached films of the varnishes were immersed in distilled water. After immersion, the films were dried out and reconditioned at 20° C and 65% rel. humidity. The tensile tests therefore were not determining the properties of the moist films, but the properties of the films after reconditioning. The results are shown in Table 3. The effect of water immersion was not large with the oleoresinous varnishes, but the water immersion and leaching out had a definite stiffening effect on the alkyd films, in relation to the type and quantity of the hard resin added.

Films Exposed to Accelerated Weathering

After drying during various times (approx. 35 days) at 20° C and 65% rel. humidity, the films, applied on the tinfoil covered glass plates were put in the accelerated weathering apparatus (The Paint

Tensile gm/mm ²	Modulus gm/mm ²	Elong. %
35 (**)	12	32
44	14	41
49	9	75
79	10	105
68	13	58
92	25	65
86	20	54
107	29	74
206	27	71
295	49	78
242	43	90
420	114	82
62	9	70
68	16	86
49	11	48
68	19	40
310	50	101
465	70	133
365	125	145
330	215	111
262	54	100
680	242	107
800	152	114
720	545	78
800	430	80
920	810	64
1080	990	77
1660	1360	7
430	55	131
760	350	120

Table 3. Mechanical properties vs. effects of water immersion of varnishes.

**The first value is for an unsoaked film; the second value is for a film soaked approx. 18 days.

Research Station model, according to B. S. Specification 987, built by J. B. Marr & Co., Ltd. Twickenham). (Fig. 14).

Experiments were made with the following series of arbitrarily chosen cycles.

- 15 hours radiation and spray combined, followed by
- 3 hours water spray alone, followed by
- 4 hours radiation alone, and
- 2 hours rest and inspection

24 hours.

The sequence of these changes involves fluctuations in temperature e. g. during the lighting and the extinguishing of the lamp.

After the treatment in the weathering apparatus the films were detached and stored in the conditioning room for four days. Other samples of the same films were stored during the same total period in the air-

conditioned room and were tested for comparison. (Table 4 and Figs. 15 through 18).

The results of these tests are of interest in respect of the difference between the oleoresinous and the alkyd varnishes and the influence of the addition of hard resins.

Analogous to the results on films exposed outdoors during some months, almost no changes in the properties of the pure bodied oil films occurred during 4 and 9 cycles.

The addition of hard resins gave some stiffening effect. The resin No. 17 in varnish 0-17-15 gave a large increase in modulus.

Neither the tensile strength nor the elongations at break showed a marked deterioration. The same effect was observed during the experiments with radiation and immersion separately in the preceding paragraph.

The alkyd films on the other hand, showed appreciable alterations during the short periods of exposure in the weathering apparatus. After 4 cycles the pure alkyd film still had good properties but after 9 cycles the distensibility was lost; the film became more brittle than after 3 months of outdoor exposure.

The alkyd varnishes with hard resins were all brittle after 9 cycles, even most of them became brittle after 4 cycles. The action of the apparatus obviously has a very damaging effect on this type of varnish.

PIGMENTED FILMS (PAINTS)

Experiments have been made with paints by methods similar to those described for the varnishes, viz.:

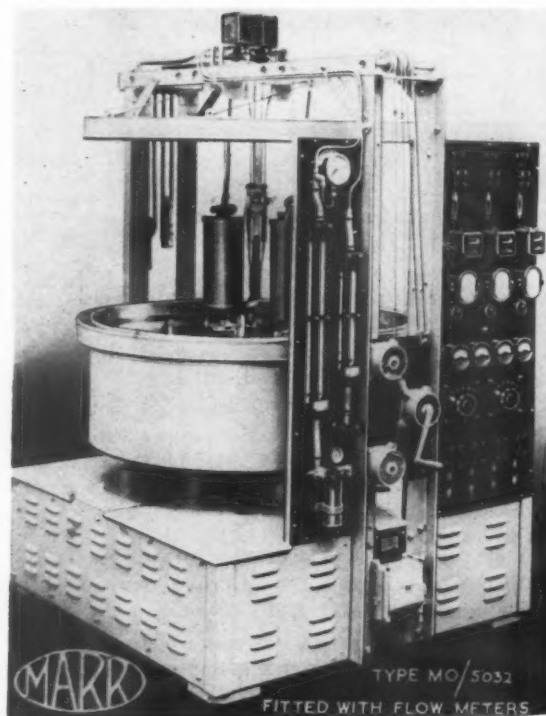


Figure 14. Accelerated weathering apparatus.

ACCELERATED WEATHERING TEST Time in 0,4,9 cycles

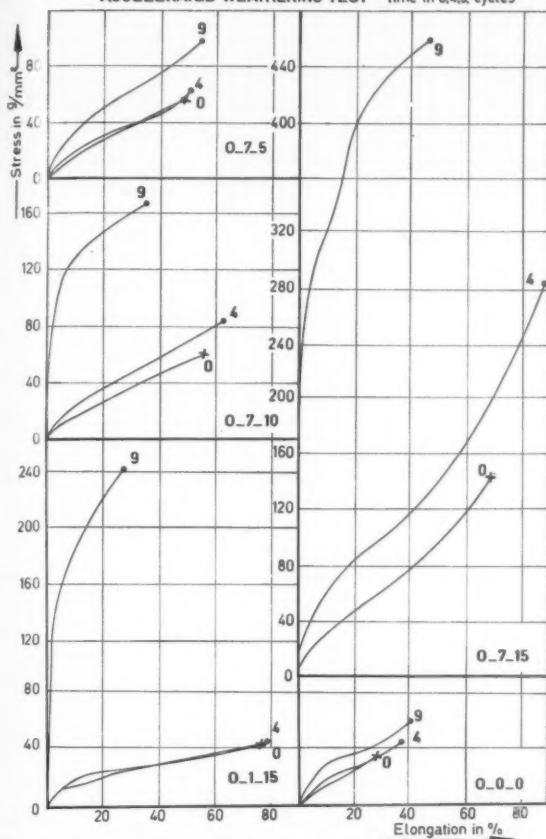


Figure 15. Stress-strain curves of varnish films exposed to accelerated weathering test. Varnishes 0-0-0, 0-1-15, 0-7-5, 0-7-10, and 0-7-15.

ACCELERATED WEATHERING TEST Time in 0,4,9 cycles

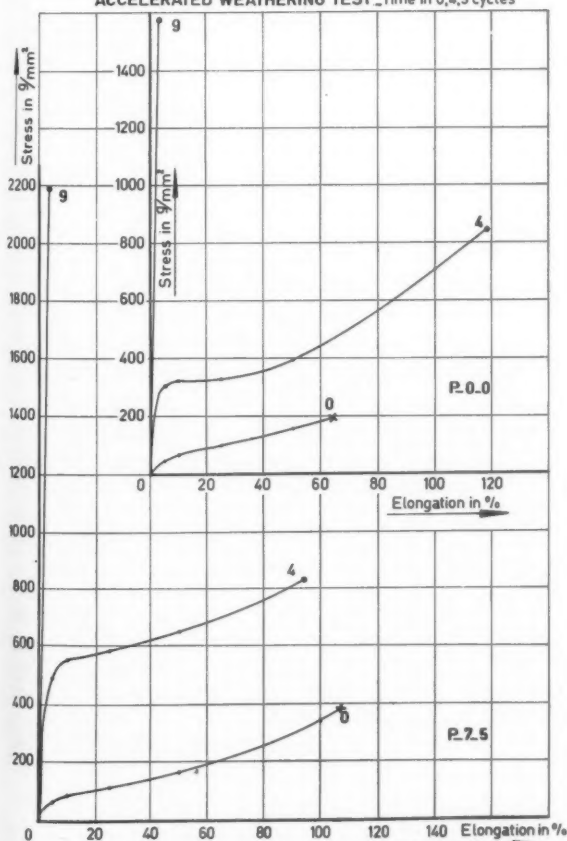


Figure 17. Stress-strain curves of varnish films exposed to accelerated weathering test. Varnishes P-0-0 and P-7-5.

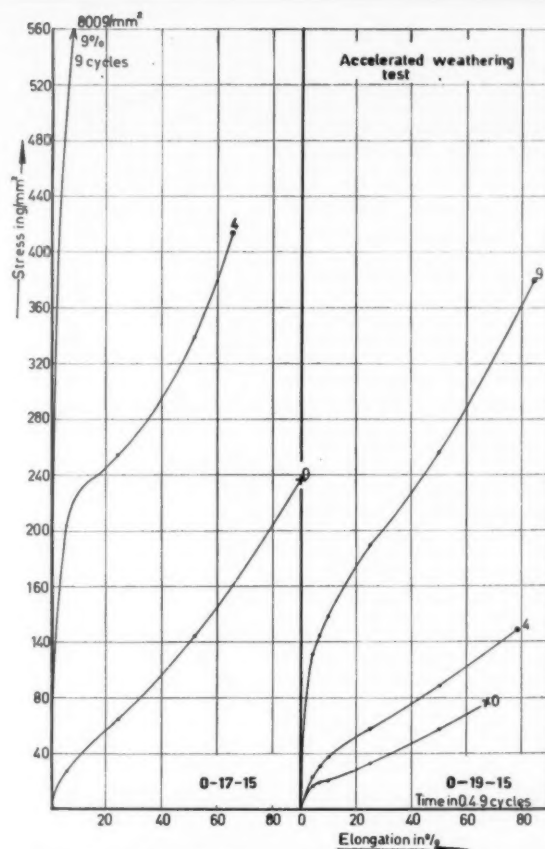


Figure 16. Stress-strain curves of varnish films exposed to accelerated weathering test. Varnish 0-17-15 and 0-19-15.

ACCELERATED WEATHERING TEST Time in 0,4,9 cycles

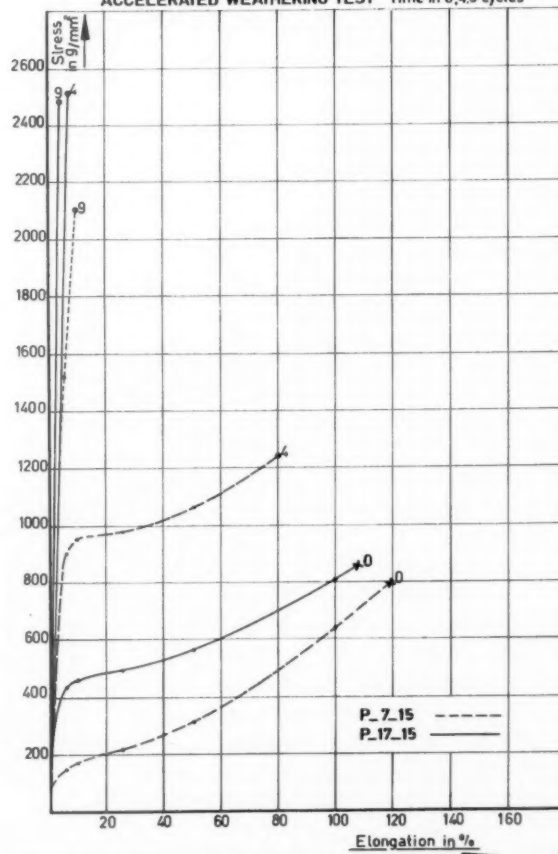


Figure 18. Stress-strain curves of varnish films exposed to accelerated weathering test. Varnishes P-7-15 and P-17-15.

Varnish No.	Tensile gm/mm ²	Modulus at 5% elong. gm/mm ²	Elong. at break %
0-0-0	36 (*)	10	29
	44	10	37
	58	19	40
0-1-15	45	13	79
	45	13	77
	240	185	28
0-7-5	56	9	49
	62	13	52
	99	25	56
0-7-10	58	10	56
	83	14	63
	165	112	75
0-7-15	142	22	70
	278	43	88
	450	285	45
0-17-15	239	33	90
	412	190	65
	760	800	9
0-19-15	76	19	67
	127	25	78
	381	115	84
P-0-0	186	52	64
	850	310	118
	1580	—	3
P-1-15	117	54	59
	—	too brittle	—
	—	—	—
P-7-5	390	63	107
	830	500	93
	2190	—	4
P-7-15	800	144	120
	1240	840	80
	2100	1340	10
P-17-15	860	420	108
	2520	2360	7
	2500	2500	5

Table 4. Tensile values of films exposed to radiation with water spray.

*First value in each group was not exposed; 2nd value in apparatus 4 days; 3rd value in apparatus 9 days.

1. Conventional exposure tests on wooden panels on test fences. Observations of cracking etc. made at appropriate intervals.
2. Films stored indoors at 20° C and 65% rel. humidity. Tensile tests made after 1/2, 1, 3, 6, 12 and 18 months of storing.
3. Films on tinfoil-covered glass-plates, exposed at test fences. Tensile tests made after 1/2, 1, 3 and 6 months outdoor exposure.
4. Films on tinfoil exposed in the humidity cabinet to 100% humidity at 45° C. Tensile tests made after reconditioning of the films.

5. Films exposed to accelerated weathering (radiation and water spray). Tensile tests made after reconditioning of the film.

Results of Exposure Tests

The following refers to the composition of the paints tested:

Stand oil paints:

Vehicle: linseed oil—tung oil stand oil 4:1, viscosity about 45 poises.

Pigments: 17 1/2 vol. percent calculated on non-volatile vehicle, of:

Paint No. 51-S: rutile titanium dioxide, non-chalking quality;

“ “ 52-S: 80 pts. rutile titanium dioxide : 20 pts zinc oxide (vol)

“ “ 53-S: 60 pts rutile titanium dioxide : 40 pts zinc oxide (vol)

“ “ 54-S: 40 pts rutile titanium dioxide : 60 pts zinc oxide (vol)

“ “ 55-S: 20 pts rutile titanium dioxide : 80 pts zinc oxide (vol)

“ “ 56-S: zinc oxide (French process).

Alkyd paints:

Vehicle: linseed oil—glycerol—phthalic anhydride resin, 16% phthalic anhydride.

Pigments: 17 1/2 vol. percent calculated on non-volatile vehicle of

Paint No. 31 A: rutile titanium dioxide, non-chalking quality;

“ “ 32 A: 80 pts rutile titanium dioxide, 20 pts zinc oxide (vol)

“ “ 29 A: anatase titanium dioxide

“ “ 43 A: lead titanate

“ “ 36 A: zinc oxide (French process).

Spruce panels primed with a 50/50 white lead/zinc oxide linseed oil primer, filled with a boiled linseed oil water emulsion knifing putty with 33% white lead in the pigment, and undercoated with a 50/50 white lead—zinc oxide linseed oil/linseed stand oil (90/10) undercoating paint, were top coated with the above-mentioned finishing paints, and exposed on test fences facing South at 45°.

The results of the outdoor exposure tests are briefly given in Table 5. These exposure tests were made on wooden panels on test fences facing south at 45° C.

The specific effects of the pigment in the same vehicles are clearly shown and do not need further comment.

Results of Tensile Tests

Films Stored Indoors at 20° C and 65% R.H.

Tensile tests were made with films, stored at 20° C and 65% rel. humidity after 1/2, 1, 3, 6, 12 and 18 months after the application of the paints on tinfoil.

For comparison, the same was done with the films of the two vehicles unpigmented.

Fig. 19 shows the tensile curves of these unpigmented films. It was not possible to make tensile tests of the stand oil vehicle before 12 months, owing to the weakness and the tackiness of the films. The alkyd film however, readily obtained a much greater tensile strength and modulus.

Fig. 20 shows the tensile curves of the stand oil paints, pigmented with rutile titanium dioxide, with zinc oxide and with mixtures of the two pigments.

Paint No.	Pigmentation Stand oil paints	Time of failure in months			Condition after 2 years		
		Crack.	Peel.	Chalk.	Crack.	Peel.	Chalk.
51 S	rutile TiO_2	—	—	8	—	—	XXXX
52 S	80% TiO_2 -20% ZnO	—	—	9	—	—	XXX
53 S	60% TiO_2 -40% ZnO	—	—	9	—	—	XXX
54 S	40% TiO_2 -60% ZnO	—	—	9	—	—	XXXX
55 S	20% TiO_2 -80% ZnO	24	—	8	XX	—	XXXX
56 S	Zinc oxide	10	18	8	XXXX	XX	XXX
Alkyd paints							
31 A	rutile	—	—	—	—	—	—
32 A	80% TiO_2 -20% ZnO	11	—	—	XX	—	—
29 A	anatase TiO_2	11	—	—	XX	—	XXXX
43 A	Pb titanate	24	—	—	X	—	—
36 A	zinc oxide	8	8	—	XXXX	XXX	—

Table 5. Atmospheric performance of paints applied to wood.

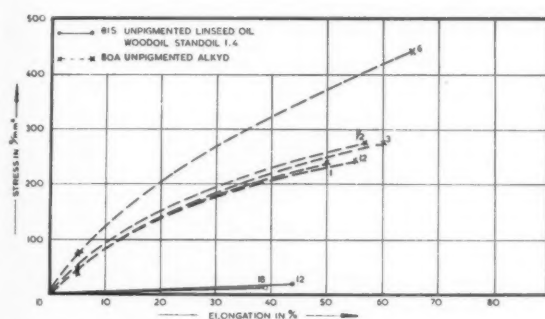


Figure 19. Stress-strain curves of unpigmented alkyd and stand oil films. Time in months.

It is clear, that even in the case of the mixture of 20 parts zinc oxide and 80 parts rutile, the presence of zinc oxide had a stiffening effect on the film: zinc oxide obviously being reactive with the stand oil vehicle.

Fig. 21 and 22 show the tensile curves of the alkyd paints, pigmented with rutile titanium dioxide, anatase titanium dioxide, lead titanate, zinc oxide and a mixture of 80 parts rutile and 20 parts zinc oxide.

The specific effects of the respective pigments are clearly show. Zinc oxide being very reactive gave in a relatively short time a very brittle film, the elongation at break being less than 10%. Rutile titanium dioxide and lead titanate gave indications of slight reactivity with the vehicle: the films gradually stiffened to some extent, but the tensile strength as well as the elongation at break remained at a high level.

The anatase titanium dioxide had no noticeable effect on the film formation, being a typical "inert" pigment.

The alkyd paints had a much greater tensile strength than the stand oil paints: they were definitely much stronger, a property which undoubtedly can be brought in relation with the well-known general good qualities of alkyd paints.

The addition of zinc oxide however has to be considered very carefully in outdoor practice.

Films Exposed to Weathering Test Fences

These experiments on paints were similar to those

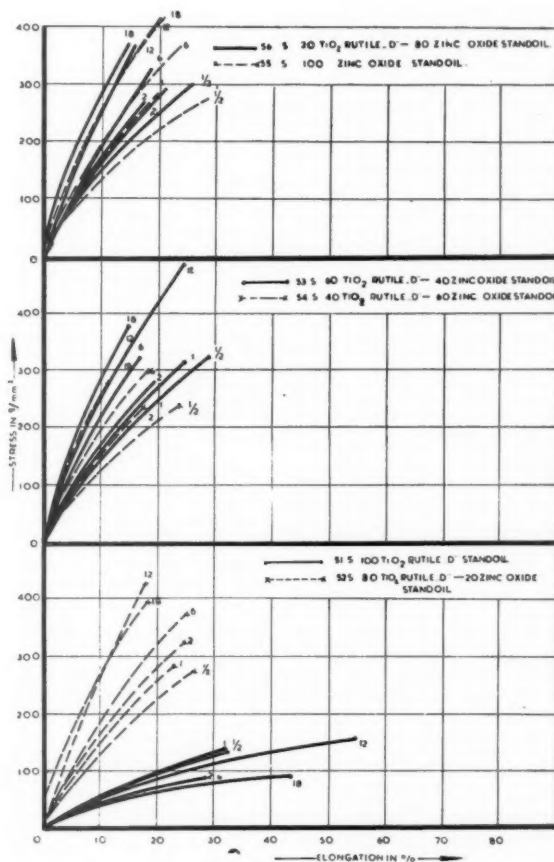


Figure 20. Stress-strain curves of stand oil paints, pigmented with white pigments, stored indoors, time in months.

done with the varnishes (par. 5.3.). The glass plates with tinfoil were coated with paint, left to dry and hardened for two weeks indoors at 20° C and 65% rel. humidity, and then exposed facing South at 45° on test fences.

Three alkyd paints are dealt with here:
Vehicle: linseed oil—glycerol—phthalic anhydride
alkyd resin, 17% phthalic anhydride.

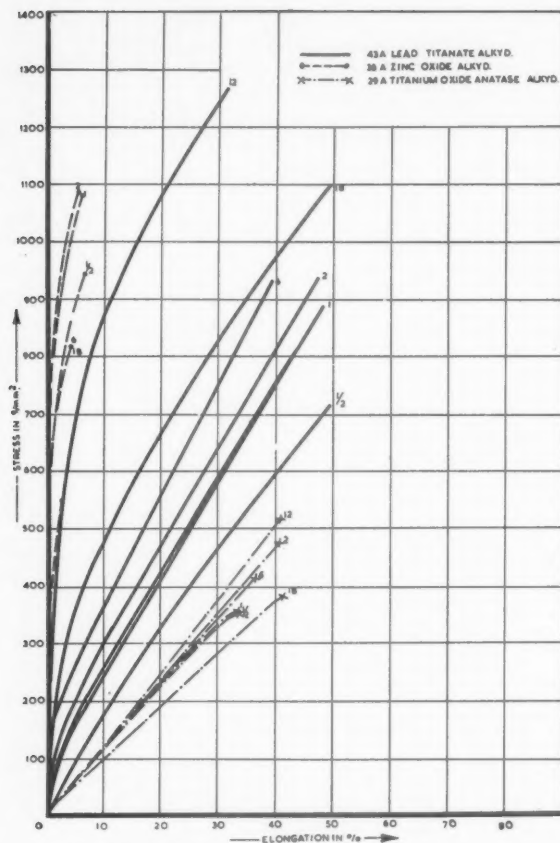


Figure 21. Stress-strain curves of alkyd paints, pigmented with zinc oxide, lead titanate and anatase titanium dioxide, stored indoors, time in months.

Pigments: 17½ vol. percent, calculated on non-volatile vehicle, of

Paint No. 148: zinc oxide

" " 154: anatase titanium dioxide

" " 160: rutile titanium dioxide, non-chalking quality.

Figs. 23, 24 and 25 show the tensile curves. The reactivity of the zinc oxide with the alkyd vehicle clearly had a very embrittling effect on the films after some months of outdoor exposure. The tensile tests showed this phenomenon in a much shorter time than the conventional weathering test, where the beginning of cracking was observed after 8 months of exposition. The anatase paint showed heavy chalking, but retained its tensile properties fairly well during the weathering. The elongation at break remained almost unchanged, but the film showed steady chalking and erosion.

The rutile paint showed no chalking before 12 months exposure. The tensile properties did not deteriorate, the elongation at break stayed fairly near to the original level. The modulus increased outdoors at a much faster rate than indoors.

Films Exposed to 100% R.H. and 45° C.

Experiments have been made with the three white alkyd paints No. 148, 154 and 160 mentioned in par. 6.3., by exposing films of these paints, applied on tinfoil, in a humidity cabinet to 100% humidity and 45° C.

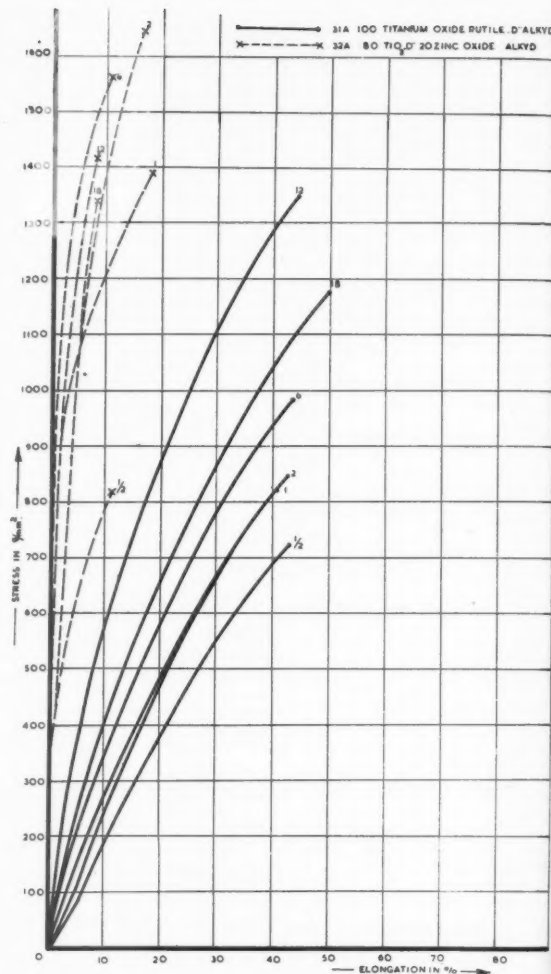


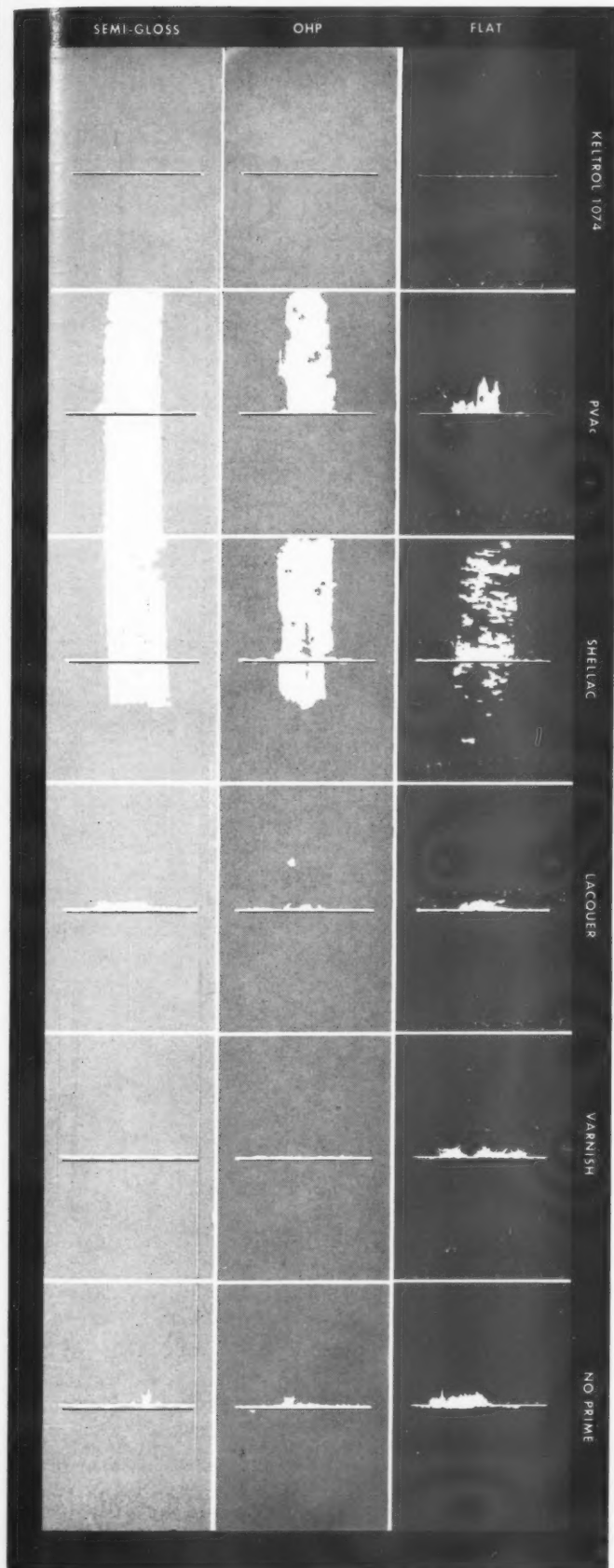
Figure 22. Stress-strain curves of alkyd paints, pigmented with rutile titanium dioxide and with a mixture of 80 parts rutile titanium dioxide and 20 parts of zinc oxide, stored indoors, time in months.

The paints were applied in the usual way by spinning on glass discs covered with tinfoil. After drying and hardening during two weeks in the air-conditioned room at 20° C and 65% rel. humidity, parts of the films were cut out and glued to rectangular glass plates.

The plates were hung in an air thermostat, on the bottom of which a layer of water was heated by a heating coil, so as to form a humidity cabinet.

The air above the water was kept at 45° C by means of a contact thermometer. After 4, 8, 12 etc. days in the cabinet, parts of the films were cut out and stored for 24 hours at 20° C and 65% relative humidity. The films were detached and submitted to tensile tests. The results of the tests are shown in Table 6.

These experiments were notable for the behavior of the zinc oxide alkyd paint film which under the humid and hot conditions swelled and shrivelled heavily. After reconditioning, the increase of the modulus and the decrease of the elongation at break were quite definitely after only 4 days exposure in the humidity cabinet.



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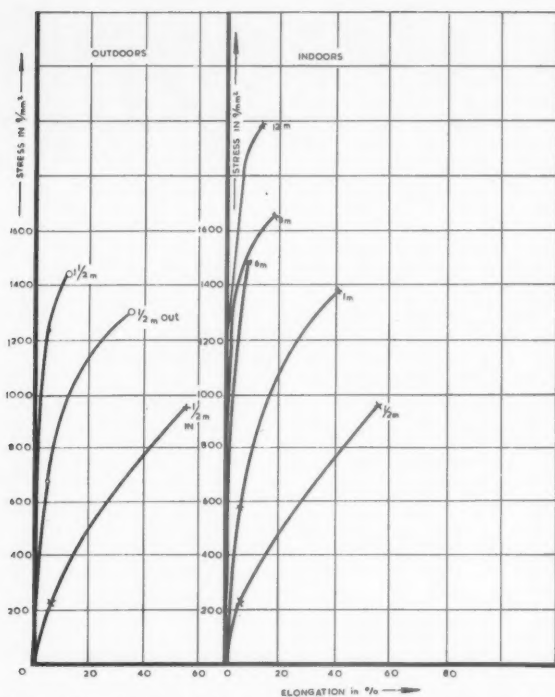


Figure 23. Stress-strain curves of zinc oxide alkyd paints, stored indoors and exposed on test-fence.

On the other hand the titanium dioxide alkyd paints did not show lasting effects of the humidity test during 3 months; after 6 months the films were degraded.

Films Exposed to Accelerated Weathering

Films of the three white alkyd paints No. 148, 154 and 160, were applied on tinfoil on glass plates and left during two weeks in the air-conditioned room.

Then the painted plates were exposed in the accelerated weathering apparatus, to a series of cycles mentioned in par. 5.6. After various numbers of cycles, samples were cut out and reconditioned for 5 days at 20° C and 65% rel. humidity. Simultaneously films of the same paints were stored in the air-conditioned room, during the same total period of time and submitted to tensile tests for comparison.

The results of the tensile tests in Fig. 26 show that after only 4 cycles the zinc oxide alkyd paint had lost its distensibility and became very brittle. The other paints retained their distensibility fairly well, although the modulus had a tendency to increase.

Discussion of the Results

From the experimental data it is possible to arrive at some general conclusions concerning film properties as revealed by the scope of the experiments.

The results of tensile tests with varnishes and paints based on *alkyd resins* correlate very well with the outdoor durability on wooden panels.

The aging of alkyd varnishes and paints is mainly a stiffening process, to be conceived as a growing of macromolecules. This stiffening process is promoted by internal factors such as the presence of special "hard" resins or of special "reactive" pigments.

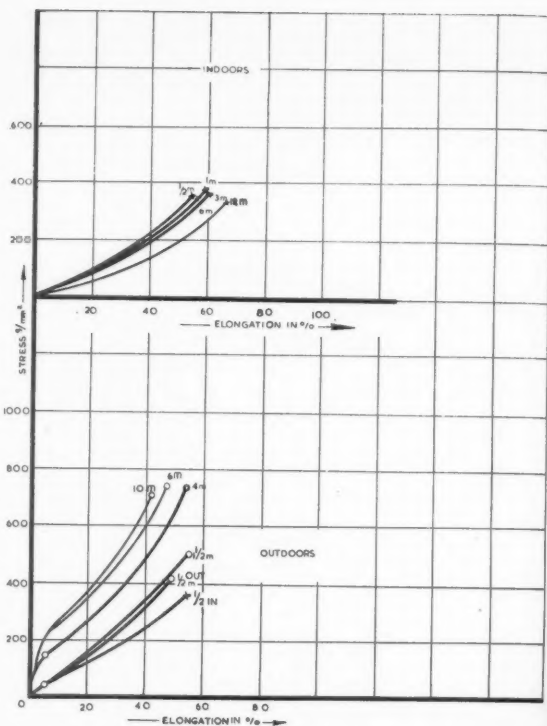


Figure 24. Stress-strain curves of anatase-titanium dioxide alkyd paint, stored indoors and exposed on test-fence.

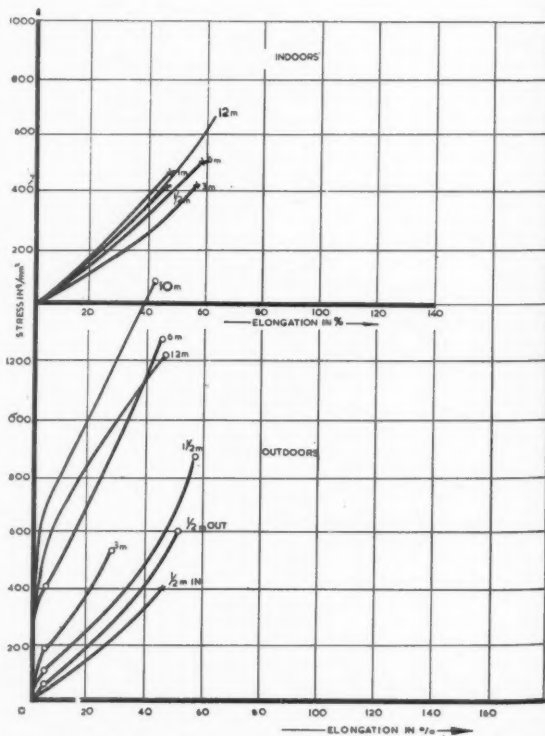


Figure 25. Stress-strain curves of rutile-titanium dioxide alkyd paint, stored indoors and exposed on test fence.

It is also promoted by external agents such as light, humidity and temperature.

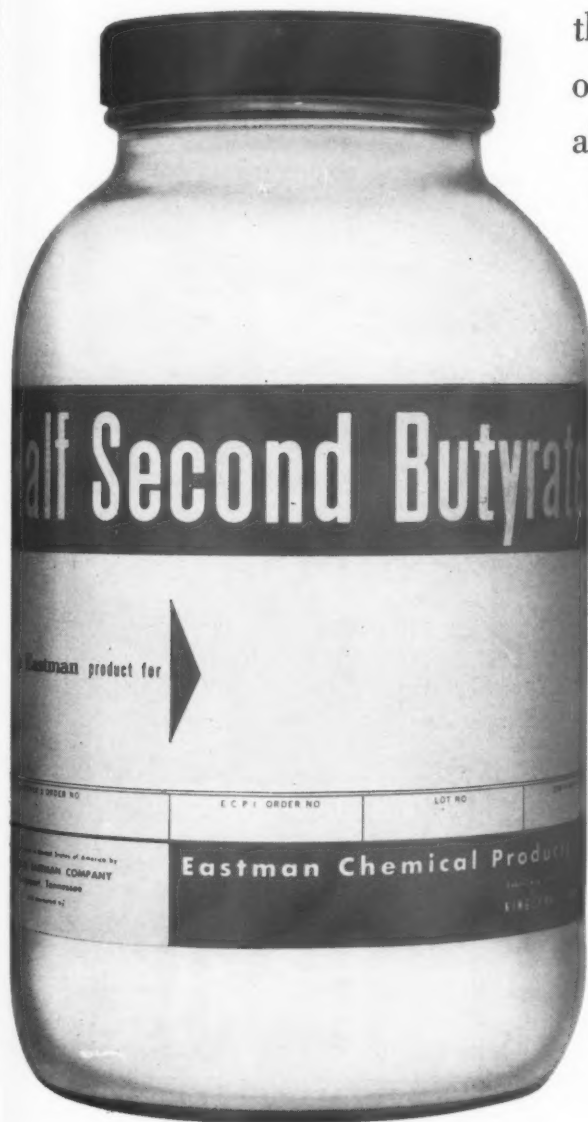
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Paint number	Tensile gm/mm ²	Modulus at 5% elong. gm/mm ²	Elongation at break %
<i>148 Alkyd-ZnO</i>			
14 days at 20°, 65% R.H.	950	232	56
4 days at 45°, 100% R.H.	1150	730	15
8 days at 45°, 100% R.H.	1430	1250	11
12 days at 45°, 100% R.H.	totally shriveled, useless.		
<i>154 Alkyd-anatase</i>			
14 days at 20°, 65% R.H.	360	34	54
4 days at 45°, 100% R.H.	250	23	54
12 days at 45°, 100% R.H.	270	53	50
63 days at 45°, 100% R.H.	175	17	69
3 mos. at 45°, 100% R.H.	115	27	62
6 mos. at 45°, 100% R.H.	49	38	41 (*)
<i>160 Alkyd-rutile</i>			
14 days at 20°, 65% R.H.	410	37	47
4 days at 45°, 100% R.H.	620	67	49
12 days at 45°, 100% R.H.	880	100	52
63 days at 45°, 100% R.H.	500	66	49
3 mos. at 45°, 100% R.H.	580	148	41
6 mos. at 45°, 100% R.H.	275	171	16 (*)

(*) Films porous and damaged; tests gave divergent values.

Table 6. Tensile values of white alkyd paints exposed to high humidity.

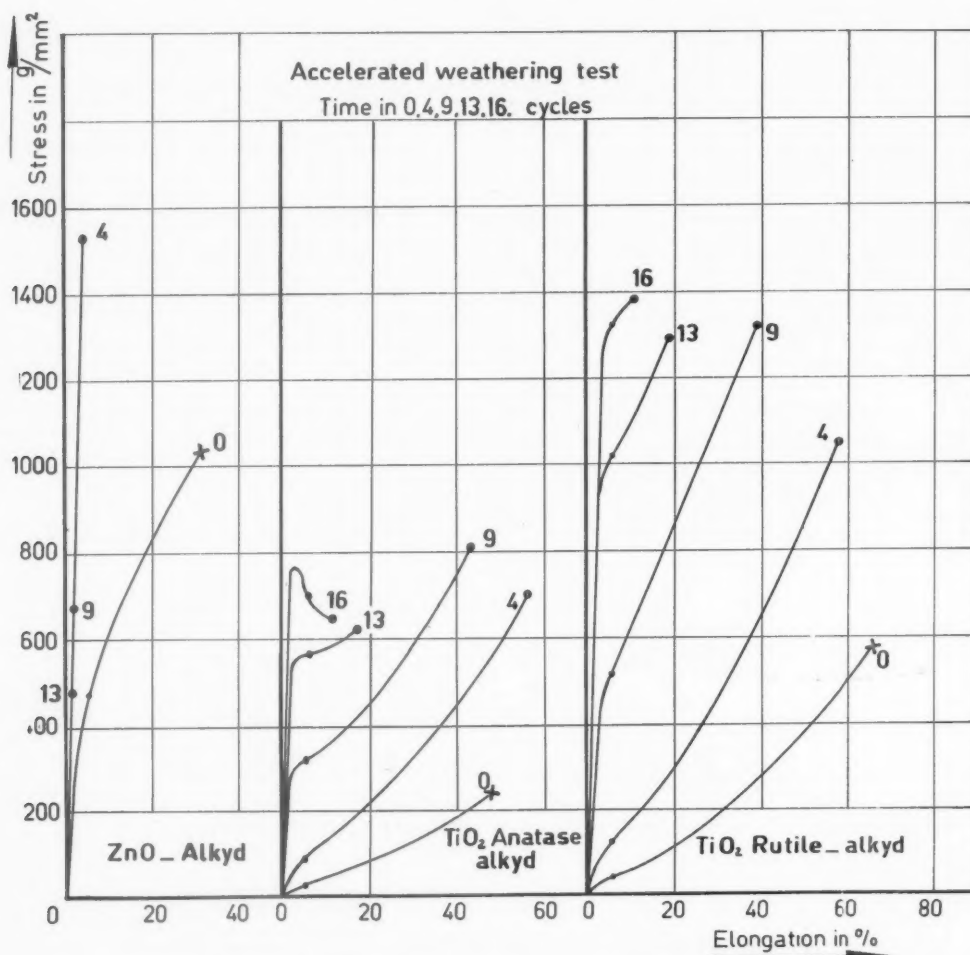


Figure 26. Stress-strain curves of alkyd paints with zinc oxide, anatase titanium dioxide and rutile titanium dioxide, exposed in accelerated weathering apparatus.

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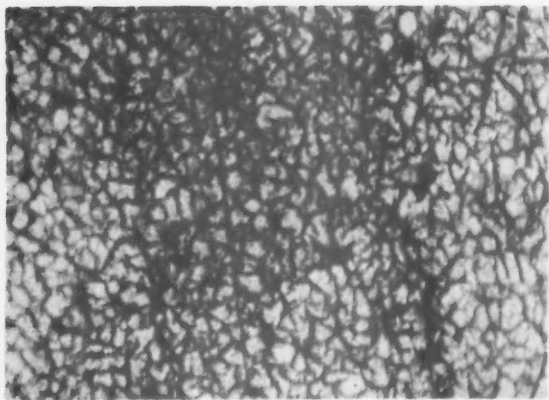


Figure 27. Varnish O-1-15 (standoil + rosin) after 15 months of outdoor exposure.

in the accelerated weathering cycles, result in a very fast embrittlement of films containing ingredients which predetermine their behavior in this direction. This embrittlement is likely to lead to cracking if the extension of the substrate results in deformation of the film.

The aging of *stand oil* and *oleoresinous varnishes* appears to be more complicated. The drying of oils being mainly an oxidation process, it may be assumed that during the aging two processes are proceeding simultaneously, namely the polymerization (growth of molecules, cross linking) and the formation of low molecular decomposition products. The aging phenomena may then be the result of a balance between these two processes.

When films are stored indoors under constant conditions, the low molecular products have little opportunity to be leached out or to evaporate; they remain in the film and have a plasticizing effect on the mechanical properties.

If on the other hand the growth of molecules is promoted by radiation, or the polar low molecular decomposition products are leached out by water resp. evaporated, the scale is turned in favour of film stiffening, which however does not reach a real embrittlement during the test periods of this investigation.

The formation of cracks in oil based varnishes on wooden panels during weathering outdoors is visually of a type different from that shown by the alkyd varnishes.

It was notable that the oleoresinous films showed a pattern of very minute cracks, whereas the alkyd films with 15% hard resin showed long, straight tears like in glass. Possibly oxidation and erosion processes play a more important role in the deterioration of oil based varnishes than of alkyd varnishes (Fig. 27 and 28).

In *pigmented films* the specific effects of the several pigments are clearly shown by tensile tests. Pigments such as zinc oxide react with the vehicle, not only in the fluid paint, but also in the dried film. This reactivity may be useful in promoting the hardness of stand oil paints, but may have deleterious consequences in alkyd paints, where in the case examined resulted in

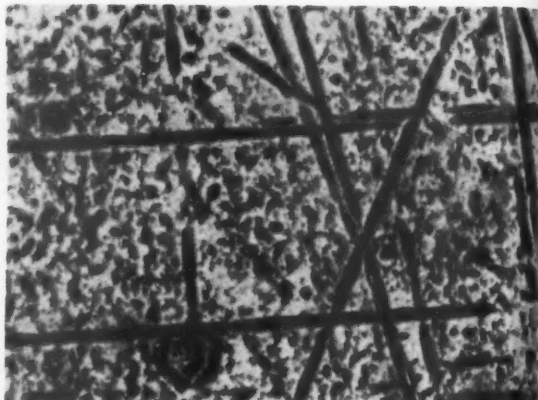


Figure 28. Varnish P-1-15 (alkyd + rosin) after 15 months of outdoor exposure.

the decrease of the elongation at break to less than 10%, and in the formation of cracks on outdoor exposure.

Some moderate reactivity seems to be existing between the non-chalking type of rutile titanium-dioxide and an alkyd medium, which may be brought into relation with the non-chalking properties of this pigment. On the other hand, the anatase titanium dioxide appears to be completely inert.

Tensile tests made with films after outdoor exposure may reveal alterations in properties in a much shorter time than they become perceptible by visual inspection of test panels.

The actions of radiation and of water seem to result in analogous changes in the mechanical properties of varnish films.

The combined actions of radiation and water, as applied in accelerated weathering apparatus, result in very fast changes in mechanical properties.

The experiments in this paper should be extended to include the actions of other cycles of radiation and water spray, in order to develop a well warranted accelerated weathering test.

Acknowledgement

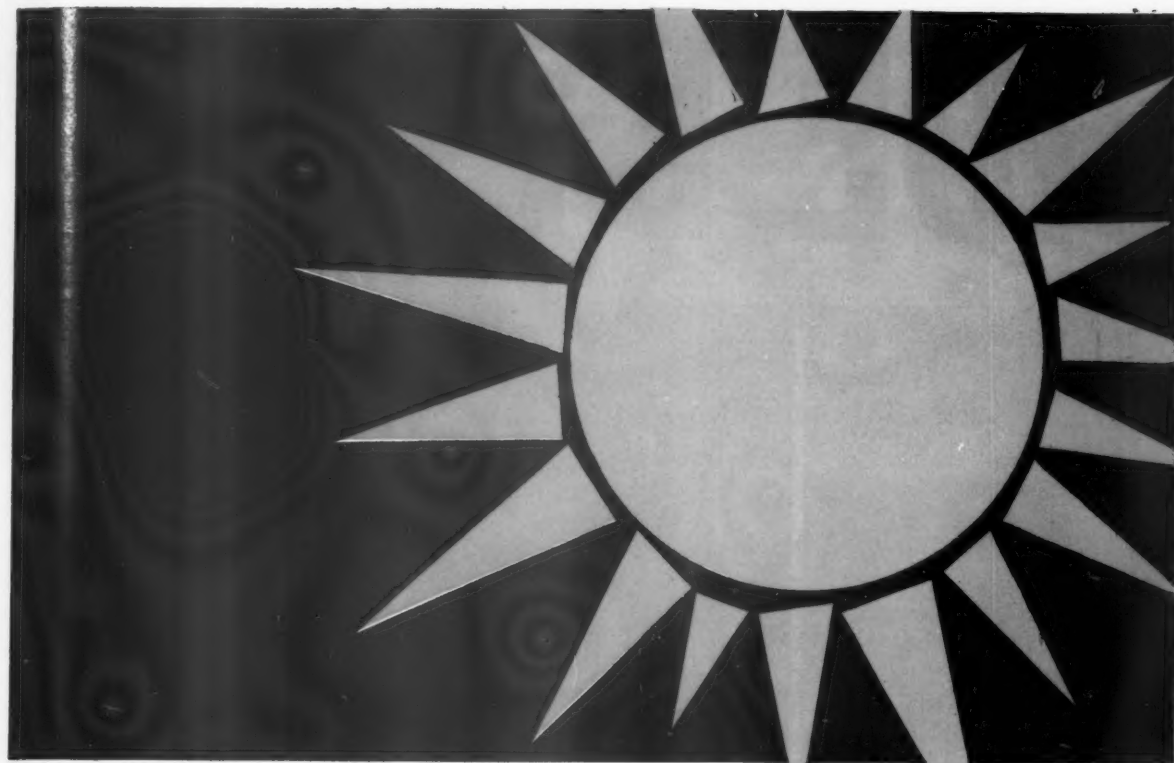
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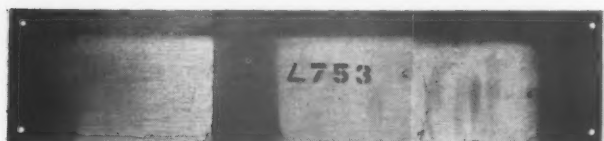
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Paints, Water-Base	X	X	X	XX	XX		
Polyester Resins	XX			X			X
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Polyvinyl Chloride (PVC)	X		XX			X	
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ALKYD RESINS -- RECENT TRENDS

Part I—Economics and Threats to Alkyd Growth

NO subject has been more thoroughly discussed in the protective coatings literature of the past two decades than have alkyd resins. The reason: there is more to be said about this area of protective coatings' technology than any other of the numerous facets of this complex industry.

Alkyd resins account for the bulk of the resin sales and associated dollar volume in the paint industry, for they constitute about half of all the resins used in organic coatings. Correspondingly, alkyd resins provide the basis for much of the research carried on in paint companies over the past two decades. Here the paint chemist has made continuing and successful efforts to improve alkyd resin formulations, to extend their uses, and to find ways of combining them with other resins in order to achieve a union of optimum properties. In the same vein, manufacturers of raw materials for alkyd resins have expended many millions of dollars on research in these areas with the net result that basic raw materials for alkyds are produced today in tremendous tonnages at low costs. And a vast series of potential raw materials, each one claiming that it will improve one or more specific properties, continually await the attention of the paint chemist.

Typical of the numerous reviews which have been published on alkyd resins is the series of papers delivered at a symposium entitled "Time of Transition of Alkyd Resins". This symposium was sponsored by the Glycerine Division of the Association of American Soap and Glycerine Producers, Inc., early in 1959 and was reprinted in the March, 1959 issue of *Paint and Varnish Production*.

Functionality

The evolution of the paint industry from linseed oil through oil-resin combinations or varnishes and through alkyd resins to the newer synthetics—which seem to make the vistas of the paint chemist boundless—has been traced many times. The important point is that alkyd resins represented the first de-

This review article will describe the economics of the alkyd resin industry as related to the overall protective coatings' industry. Some of the threats to alkyd resin growth which have arisen in the past few years will be discussed briefly after which trends will be described in alkyd raw materials and in alkyd formulations, particularly as related to the combination of alkyds with other resins. The trends in water-dispersed or water-soluble alkyds will be discussed, and emphasis will be placed on the recent patent literature and recent articles from which may be gained some insight into the trends in alkyd resin research in the various laboratories throughout the country.

parture in which the chemist took advantage of theoretical considerations of functionality—the basis for modern polymer and resin chemistry—in order to improve on nature.

When nature gave us linseed oil, she provided a molecule with two sources of functionality. One of these is in the trihydric nature of the glycerol molecule to which may be attached three fatty acid residues. The second is in the unsaturation of the fatty acid residues which makes possible cross-linking by oxidation so that the liquid material may be converted to a hard, flexible adherent film.

Once the chemist was aware of the concept of functionality and the sources of this functionality in the linseed oil molecule, he immediately realized that he had at his disposal tremendous power for improving on nature. One obvious way to increase the functionality of linseed oil is to increase the unsaturation of the fatty acid residues. Nature has already done this for us in tung and related oils which are very valuable raw materials for paints but which have certain limitations. Dehydrated castor oil is an example of the chemists' approach to increasing functionality via increasing unsaturation.

Another obvious way to improve on linseed oil is to replace the trihydric alcohol, glycerol, with a more functional material such as the tetrahydric alcohol,

pentaerythritol. This gave rise to the "reconstituted oils" such as pentaerythritol soybean fatty acid esters which are certainly improvements over nature, but which also do not have the wide applicability of the alkyd resins.

A third approach to increasing functionality, and one which is not quite so obvious as the two mentioned above, is to design a molecule which has polymeric character. When linseed oil dries, as is well known, it is converted to a polymer by the process of oxidation. There are many other means for achieving polymeric character, one of the simplest being by the condensation of two di- or polyfunctional reagents, such as a glycol and a dibasic acid to obtain a polyester. In oil modified alkyd resins, the paint chemist incorporates polymeric character—actually, a polyester—into an oil. He does this by combining polyester-forming ingredients such as phthalic anhydride and glycerol with non-resin forming ingredients—namely, fatty acids. The fatty acids, of course, may be used as such or they may be derived from an oil. And if they are unsaturated, they contribute functionality to the alkyd resin, just as they do to linseed oil.

Polymer theory indicates that, if a condensation polymer is made from reagents which have a functionality greater than two (such as glycerol which has a functionality of three), gelation will ultimately result unless the ratio of the reagents is properly controlled or unless the reaction is stopped short of completion. These are some of the factors which the resin chemist must bear in mind as he formulates alkyd resins for his net result must be a liquid material which can be coated on a substrate where further polymerization will convert it into a hard film. In this latter respect, then, the alkyd resin is like linseed oil. However, by introducing polymeric (in this case, polyester) character into the structure of his product, the paint chemist has reduced greatly the amount of further polymerization—achieved either by oxidative cross-linking or by heat—necessary to convert his liquid product to a solid film.

Since the required further polymerization is so much less in an alkyd resin than it is in linseed oil, and since it can be controlled, "drying" no longer becomes the controlling factor as it is with natural oils.

Modifiers

Thus, the paint chemist may formulate alkyd resins with a wide variety of materials. One of the immediate obvious advantages is that he may use to good advantage low cost oils which normally do not dry by themselves—i.e., the so-called semi-drying oils, like soybean oil. In the same category are the inexpensive tall oil acids which have become important factors in alkyd resin technology in the last four years.

Indeed, an excellent example of the power of functionality is demonstrated by certain short oil alkyds which contain saturated rather than unsaturated acids. Even so, they still have sufficient functionality to contribute film-forming characteristics, especially in combination with other resins such as the melamine or urea-formaldehyde resins. The virtue of lack of unsaturation, incidentally, is the excellent color which lack of double bonds contributes.

As the paint chemist gained more insight into poly-

mer chemistry, he realized that his alkyd resins, with their unsaturation, may be copolymerized with other inexpensive, unsaturated materials such as styrene. The net result is a complex copolymer of alkyd resin and polystyrene which has found wide use in industry in the last ten years.

Alkyd resins may be formulated with excess functional groups in the molecule such as free hydroxyl groups or free carboxy groups. These provide a basis for attachment to other materials such as a wide variety of resins which react with hydroxyl or carboxyl groups. Thus, as will be seen later in the article, alkyd resins may be formulated with almost all of the other synthetic and natural resins used by the protective coatings' industry to reinforce poor properties and emphasize good ones. At the same time, alkyd resins demonstrate good compatibility with a variety of other materials for which reason simply combinations are possible.

These same functional groups, when left unreacted in the molecule, provide the basis for emulsifiable alkyds which are now making their bid for frame in both industrial applications and in the areas where latex paints have proved so successful.

ALKYD RESIN ECONOMICS

The alkyd market is dominated by major chemical producers, some of the most significant of whom are the following: Allied Chemical Corporation, American Cyanamid Company, Archer-Daniels-Midland Company, Cargill, Inc., The Glidden Company, Hercules Powder Company, Devoe and Raynolds, Reichhold Chemicals, Inc., Rohm and Haas and Sherwin-Williams Company.

Production

Table I shows the production figures for alkyd resins from 1945 when less than 200 million pounds were

TABLE I

UNITED STATES PRODUCTION OF ALKYD RESINS

Year	Production of All Alkyd Resins in Millions of Pounds	Estimated Unit Price of Phthalic Alkyd Resins, per Pound
1945	192.6	\$0.25
1946	245.4	0.28
1947	283.1	0.39
1948	288.3	0.41
1949	316.4	0.29
1950	402.0	0.31
1951	440.3	0.36
1952	431.3	0.31
1953	466.5	0.31
1954	453.6	0.30
1955	543.2	0.29
1956	473.8	0.31
1957	528.6	0.35
1958	502.6	0.31
1959	560.0	0.33
1960	512.0*	

*Estimated

produced to 1959 when an estimated 594 million pounds were produced. From this table, it is obvious that alkyd resin growth in the decade from 1945 to 1955 was vigorous, with production at the end of the ten year period being 2.8 times greater than at the start. In 1955, however, one may observe the corrosive effects on alkyd volume of new technology. What these are will be discussed later.

The unit price of alkyd resins, as indicated in Table I, is an indication that inflation has not exerted its usual effect in this area due to a variety of factors including competition, over-capacity and technological improvements which have made possible economies in raw material production as well as in production of the alkyls themselves.

Taken by themselves, the figures of Table I are highly impressive. They become even more so when one compares them to the total volume of resins employed by the surface coatings' industry. Over the past 35 years the protective coatings' industry has utilized resins in ever-increasing quantities, achieving a 300 million pound level during World War II. After World War II resin usage by the paint industry plateaued at something over 600 million pounds per year for five years after which steady growth followed with the achievement of a usage of 830 million pounds in 1957.

Breakdown of Coating Resins

It is obvious that alkyd resins account for something over half of the total resins employed by the surface coatings' industry. The remainder is divided between rosin esters and its derivatives, styrene, cellulosic resins, urea and melamine resins, vinyls, phenolics and related tar acids, coumarone-indene resins, acrylics, epoxies, and silicones. Interestingly enough, all of the resins which make up the rest of the market may be used, and most of them frequently are used, in combination with alkyd resins.

It is interesting to note the impact which alkyd resins have had on other raw materials for protective coatings, particularly drying oils which were the mainstay of the industry prior to the advent of alkyd resins. This is particularly noteworthy for several reasons to be discussed later. Statistics indicate that in 1931 approximately 524 million pounds of drying oils were used in surface coatings. This usage had increased to 835 million pounds by 1956. On the face of it, this increase is an impressive one. In terms, however, of the tremendous growth which the coatings' industry has undergone, these figures lose much of their impressive character. Thus, as pointed out by Sayre in a talk presented to the Association of American Soap and Glycerine Producers, Inc., on January 23, 1958, in the quarter of a century between 1931 and 1956, the pounds of oil used in a gallon of the average surface coating decreased from 2.4 to 1.4. Thus, potential usage was decreased by this sort of reformulation by 600 million pounds per year.

It is interesting, also, to note that linseed oil's supremacy has been threatened not only by alkyd resins *per se* but also by the fact that alkyd resins have made possible the use of less highly functional ma-

terials such as soybean oil and tall oil fatty acids. The importance of this latter statement is indicated by statistics which indicate that, during 1956, 380 million pounds of linseed oil were utilized by the surface coatings industry. At the same time, 240 million pounds of soybean oil and 34 million pounds of tall oil were used.

To summarize, it is obvious that alkyd resin technology interfered markedly with the growth of linseed oil as a paint vehicle, while at the same time providing an outlet for soybean oil and tall oil fatty acids in protective coatings. Even so, tremendous volumes of linseed oil are still produced and utilized today. Just as alkyd technology slowed the expansion of linseed oil, it was to be expected that newer advances would slow the growth of alkyd resins. With the advent of latex paints, epoxy resin esters and a variety of other synthetic resins, this has indeed proved to be true.

Two factors, however, must be born in mind. The first of these is that alkyd resins will never be completely replaced in the foreseeable future and will be produced in huge volumes in the same manner that linseed oil is still produced in large volume. The second point is that the inroads made by more advanced materials on alkyd volume can be counteracted by continuing research which will lead to improved or to more economical alkyd type vehicles. This very important point will be discussed later in the article.

Paint Production and Consumption

It is interesting at the same time to examine some of the statistics which affect the volumes of the paint industry as a whole, for practically anything which applies to the paint industry applies also to alkyd resins which are such an important part of it. Absolute gallonage figures in the paint industry have increased to a point at a truly phenomenal level. In 1931, 218 million gallons of paint were sold. A high of 600 million gallons was achieved in 1955, but in 1959 the figure was 304 million gallons. Dollarwise, the industry has gone from 350 million dollars in 1931 to 1.5 billion dollars in 1957 and 1.7 billion dollars in 1959. This vast dollar increase is, of course, due in large measure to inflation.

Important in the growth of the paint industry, as in the growth of all industries, is the rising population. However, one must always be keenly aware of per capita figures which for the paint industry have not been too encouraging. To be sure, the per capita consumption of paint has risen from 1.7 gallons in 1931 to 2.4 gallons in 1940 and 3.9 gallons in 1950. During the 1950's, however, per capita consumption has declined to approximately 3.3 gallons in 1957. This is due in part to improvements in the paint itself which makes repainting less necessary. It is also due to increased use of materials which do not require painting such as fabricated plastic parts which formerly were made from painted metal, siding for houses which does not require painting and a variety of other related materials.

To combat this, the paint industry continues to produce more highly functional paints which do better jobs in resisting corrosion, which withstand higher

temperatures and which are more resistant to solvents and chemicals. Paints are available which are almost ceramic in nature and still other paint-like materials can do a better job than concrete. More easily applied paints give greater appeal to the "do-it-yourself" market.

Thus, one may conclude that the figures shown in Table I or virtually any figures related to the growth of the paint industry or any aspect of it are the result of a continual battle of technologies in which creativity and innovation are constantly being invoked to achieve heretofore unattainable results which reflect themselves in statistics related to usage.

Just how fast the alkyd resin industry will grow in the next ten years is not clear. In large measure, this depends on the equilibrium point which will be determined by technological advances in the alkyd industry, on the one hand, and technological advances in competing areas such as latex paints and synthetic resins, on the other hand.

An interesting article in *Industrial and Engineering Chemistry* [51, 10, 31A (1959)] discusses the outlook for resin production in 1965. Grouping alkyd resins and rosin modifications together, this article indicates that in 1958, 560 million pounds of these products were manufactured. The estimated manufacturing figure for 1959 is 625 million pounds and projected for 1965 is a modest growth to 700 million pounds. Certainly, modest projections of this sort represent a distinct challenge to the technologist concerned with alkyd resins. With this in mind, let us examine some of the threats to alkyd resin growth.

THREATS TO ALKYD RESIN GROWTH

Interior Wall Paints

As much of the previous discussion has indicated, advancing technology on many fronts threatens the continuing growth of alkyd resins. It is well known, of course, that epoxy resin esters, latex paints, and other synthetic materials have inhibited the growth of alkyd resins. In order to understand fully why this is so and what the alkyd technologists may do about it, it is important to analyze usage and usage trends for alkyd resins.

This has been discussed in some detail in a recent talk by E. Scott Pattison, Manager of the Glycerine Producers' Association. One of the most important areas for alkyd resin usage, he points out, is interior wall finishes. According to *Chemical and Engineering News* (January 14, 1957, p. 14), this usage accounts for some 90 million gallons of paint, 50 per cent of which volume is now enjoyed by latex paints. The remainder is probably largely accounted for by alkyd resins. Figures such as these are indeed impressive in relation to alkyd resin growth. Trends, however, are even more interesting. After the initial excitement of the latex paints subsided, it was obvious that although they had certainly made their mark and were here to stay, they were not going to take over the entire market for interior paints. Thus, statistics available in 1956 ("Characteristics of New Housing 1954, 1955, 1956", U. S. Department of Labor, December, 1956) indicated that the market was divided equally between

latices, alkyds, and linseed oil-based paints. In the meantime, alkyd resins were starting to assert themselves once more in the form of thixotropic formulations which appeal to the "do-it-yourself" trade and also in formulations with odorless solvents.

To help their cause, alkyd producers claimed a greater choice of pigments than did the latex manufacturers and also they pointed to compatibility with oil colors and enamels and to better film building properties because of higher solids content. The latex industry countered with new latices based on vinyl and acrylic polymers which have demonstrated excellent growth. In the meantime, a compromise was offered in the form of the use of a sealer coat of latex paint followed by a topcoat of alkyd paint. Also, of course, the alkyd industry has been hard at work formulating water soluble or water dispersible alkyds in which, hopefully, the advantages of both the latex and alkyd based paints would demonstrate themselves.

Exterior Paints

In favor of the alkyds for interior wall paints, in addition to low odor provided by new type thinners, are the great durability, washability, and brushability claimed by their producers. In addition, new brush cleaners are available which tend to compensate for the fact that brushes used for latex painting may be cleaned with water.

Pattison (loc cit.) has also described some of the complex factors related to the market for exterior paints for houses. Much of the outside masonry paint for homes is now water-based. The primary loser here is linseed oil which for many years has been the important raw material for outside house paints. Alkyd resins have also been strong contenders for a portion of this market, and among the virtues claimed for alkyds are longer life, mildew and blister resistance, self-cleaning properties, and a high degree of compatibility with a large variety of pigments. Also, the trend to formulate house paints without zinc oxide has favored the use of alkyds to obtain greater film hardness.

Important in the application of alkyds in house paints is the observation that paints formulated from alkyds without conventional white lead and zinc oxide—i.e., without the usual basic pigments, provide an excellent house paint with resistance to staining and blistering. With linseed oil, of course, these pigments are necessary. Apparently, the superior film-forming properties of the alkyds provide more leeway, making it possible to pigment an alkyd only with titanium dioxide and extender pigments such as magnesium silicate. Such films, particularly when the alkyd employed has a very long oil length, are quite permeable to moisture for which reason blistering, the bugaboo of "tight" films, does not result. Also, the producers of alkyd based house paints claim that such materials when applied to new wood, demonstrate better adhesion and greater blister resistance than does linseed oil house paint applied over a primer.

The manufacturers of isophthalic acid and of tall oil fatty acids have pushed their raw materials for alkyds for outside house paints. Even so, the outside house

paint market is still dominated by linseed oil, despite the advances described above, and represents an attractive horizon for the alkyd industry.

It should be pointed out, as is well known, that trim paints which were formerly based on varnishes are now largely based on alkyd resins. According to Pattison this represents a fourteen million gallon per year volume for outdoor paint.

Industrial Paints

Continuing Pattison's outline, one must examine industrial outlets for alkyd resins. Industrial outdoor applications, represented by the need to protect structural steel, marine installations, boats, railroad equipment, and a variety of related areas, represented, in 1954, a market for approximately 25 million gallons of paint. Alkyd resins are widely used for such applications for a variety of reasons, not the least of which is their low cost and their ease of application. For example, red lead primers based on long oil modified alkyds enjoy wide usage, as do alkyds combined with a variety of other resins and vehicles. More important than decoration for such applications is protection, particularly from corrosion. It is here that the alkyd resins have been hard hit, and will continue to be even harder hit as the years go by, because of the better corrosion resistance demonstrated by epoxy resin finishes, vinyls and by some of the newer synthetic vehicles.

To be sure, these are more expensive and may require more elaborate methods of application. The strong desire, however, for improved performance, particularly relative to corrosion resistance, is indicated by the fact that it has been possible to educate painters to use the relatively cumbersome two-component finishes such as catalyzed epoxy resins and certain isocyanate paints on the basis that highly improved corrosion resistance results. To be sure, there will always be a place for alkyd resins for industrial outdoor applications, where corrosion is mild and where low cost is an important factor. Obviously, however, one of the most important means for increasing the utility of alkyd resins for outdoor use will be to find ways for improving their corrosion inhibiting properties.

Product Finishes

Probably the largest use for alkyd resin vehicles is in the field of original product finishes among which may be mentioned, in addition to automobiles, appliances, furniture, and metal equipment. Here alkyds are combined with urea or melamine resins to give finishes which must be baked at 250°F or higher to obtain optimum properties. Some of these alkyd resins are made from non-drying components like coconut fatty acids in order to obtain compositions with excellent color retention and resistance to over-baking.

Because this represents such a large market, other synthetics are continually eyeing it jealously. The automobile industry demonstrates an excellent example of the changes which advancing technology can effect. The oleoresinous varnishes of the early days of the industry were soon replaced by nitrocellulose lacquers which, because of their speed of drying, made

possible assembly line production. In the period between 1925-1935, alkyd formulations captured a large share of the automobile finishes market because they made possible more durable, tougher finishes which could be applied even faster. Also, pastel shades were possible. The advent of urea and melamine-formaldehyde resins for combination with alkyds made this technology even more firm. At the same time, chemists discovered how to combine nitrocellulose lacquers with alkyd resins and, thus, there was room for both vehicles in the automotive industry.

Very recently, high melamine content alkyds have been introduced to the automobile industry at the same time that acrylic finishes have been proposed. Both of these are now being used and are said to make possible more brilliant colors and to provide finishes which maintain their gloss longer and require less waxing and polishing.

In the area of automotive primers, epoxy resin esters and water-based materials provide a constant threat to alkyds, although alkyd resin technologists continue to try to maintain their position by formulating increasingly improved primers. The water-based paints intended for use as metal primers, particularly in the automobile industry, have largely been based on butadiene-styrene copolymers. It is entirely possible, as many alkyd technologists are trying to prove, that water dispersed alkyds may well offer industrial latices "a run for their money". And, of course, a union of latices with water soluble or water dispersed alkyds is always a possibility, particularly when one considers that the alkyds may provide improved adhesion, better pigment wetting and binding, and greater color uniformity.

Thus, a variety of new materials provide a threat to expanding alkyd usage in both trade sales and industrial areas. In addition to those already mentioned, one may add polybutadiene polymers which demonstrate an attempt to reproduce drying oil-like products from petrochemical raw materials. Although the products currently available must be cured by heat, they have the potential advantage of low cost. And this polymer is only one of several new materials on the horizon whose manufacturers gain inspiration for intensive work from the large and inviting alkyd market.

Combatting Threats

Some of the means for combatting these threats have been indicated in the above discussion. To summarize and to amplify this, the alkyd resin technologist, as well as the producer of raw materials for alkyd resins, must search continually for means for reducing cost. It is almost a truism that lowest cost products enjoy widest usage. Certainly, the advent of tall oil fatty acids and continually decreasing prices of important intermediates indicate that the alkyd industry is well aware of the need for low cost starting materials. The excellent manner in which the alkyd industry has maintained low cost for its products in spite of inflation is demonstrated by the cost figures in Table I.

(Turn to page 94)



Safflower oil formulations make all other WHITE house paints look yellow!

Make this positive test! Use Safflower oil as the base for your whitest exterior paint formulation. Compare to your present formula using any other oil base. Result: The Safflower base will produce an extremely brilliant white that makes other "true" whites look yellow or greyed.

Safflower produces a number of other outstanding advantages that will improve your formulations. Here are some of them:

NON-YELLOWING. Safflower paints have high non-yellowing characteristics not found in other oil paint formulations.

BRIGHTER COLORS. Colors pigmented with Safflower oil are brighter and clearer.

SUPERIOR THROUGH-DRY. Quick drying properties allow for recoating in shorter times.

EXCELLENT COVERING PROPERTIES. Plus high wrinkle resistance and dew flattening resistance.

STAND UP BETTER. Five year weather tests prove the durability of Safflower paints is equivalent to highest quality coatings with a linseed oil base.

For further information, write for our new brochure "Safflower Oil House Paints."

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Elbert Davis,
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Los Angeles, points out . . .

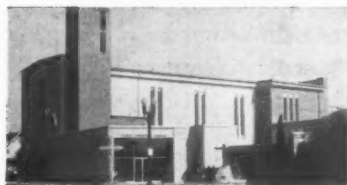
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By
Edward Anthony

The author expresses his random reflections on various aspects of the paint industry. The opinions contained in this column are his alone and do not necessarily reflect those of this publication.

The Little Things

THE trite command, "Keep your eyes open!" has so much truth embodied in it that one can almost forgive the imperious or condescending tone in which it is usually uttered. However, even the practitioner of the art in the chemical coating field can learn quite a good deal by keeping his eyes open—particularly if they are looking through a microscope.

Have you ever scratched an apparently hard film with an ordinary straight pin, while viewing the scene under 100 X magnification? It is amazing how plastic—even soft—a quite brittle coating will seem. Or consider the tremendous strains that can be set up in an organic coating during the period of solvent evaporation, as evidenced by the Benard cell formation visible under varying magnifications, depending on the grossness of the effect.

The optical microscope is almost 400 years old; the first compound instrument was invented in 1590 by Jans and Zacharias Janssen in Holland. The succeeding centuries have witnessed numerous improve-

ments on this initial development—which has meant so much to progress in many fields of science—by such men as Anthony Van Leeuwenhoek and Christian Huygen in the seventeenth century; Charles Spencer, Francis Wenham and Ernest Abbe in the nineteenth century; and Ives and Zernike in this century.

The theoretical limit to the resolving power of the light microscope was realized in 1873 with the publication of Abbe's diffraction theory (which has never been disproved) that no microscopic system can ever resolve details of an object separated by less than half the wave length of the illuminating light. This led to J. E. Bernard's microscope which utilized ultra-violet light, thus reducing the dimension of resolution from about 2500 Angstrom units (Å) to about 1000 Å.

The next big step forward in man's quest to see the small world within and about him awaited 1924 and Louis de Broglie's hypothesis of the wave nature of small particles, apparently totally unrelated to microscopy. One of the

results was a new facet of science, *electron optics*, pushed forward by such as Schroedinger, Busch, Davisson, Bruche, Johannson, and Ruska. By 1940 the Radio Corporation of America had produced the first commercial *electron microscope* with a resolving power of about 24 Å. Current models have halved even this almost infinitesimal figure. Thus in a few decades a degree of perfection has been realized with this method that the light microscope achieved in 300 years.

And what has been learned with this ingenious new instrument, almost capable of probing the very structure of molecules, of particular interest to the coatings scientist? The July 1960 issue of *Journal of the Oil and Colour Chemists' Association* includes an excellent summary article, "Electron Microscopy and Paint Technology," by S. H. Bell of England's Paint Research Station. The conclusion includes a sharp, succinct paragraph: "To assess the position merely on the basis of specific practical problems solved would be too harsh. It is possibly more important to think in terms of the general increase in knowledge that has occurred and its effects on ways of thinking about problems and about the technology generally. Having mental pictures backed by objective ones of the various pigments, the insides of paint films, substrates, etc., and of the changes that occur with time and under various influences, must affect technical thinking."

Pigments were an initial subject and lend themselves to rather extensive investigation. The size, shape, surface characteristics, etc., of most pigments have been elucidated by various techniques. The distribution of the pigment particles within a paint film has been examined.

Paint film surfaces have been studied, but much remains to be learned. Twiss, Weeks and Teague of Chrysler Corp. have reported their findings in two *Official Digest* articles, "Electron Microscope Study of Paint Surfaces" (Feb. 1956) and "Electron Microscope Study of Accelerated and Natural Weathering" (Jan. 1958). Only two other reports complete almost a decade of *Official Digest* informa-

tion on the subject, an indication of the paucity of past contributions. These are by Von Fischer, Bobalek, *et al*, of Case Institute of Technology, "Electron Microscopy of Gloss Enamel Films" (May 1952) and "Electron Microscopy in Paint Formulation" (Dec. 1955).

As Dr. Bell points out, "...electron microscopy has provided major information only about the solid, or denser, components of paint, namely the pigment or extender. More information is required about the medium, that is about molecules and polymer networks in the medium." Is this in the realm of possibility? What size range are we talking about? Bell specifies: "...the carbon-to-carbon linkage represents a spacing of about 1.5 Å and an average long chain fatty acid has a length of, say, 25 units. ... a single oriented fatty acid molecule has a width determined by the carboxyl group of about 4.5 Angstrom units. ..." Recent work on the resolution of viruses offers the hope that a new method of specimen preparation combined with new instrumentation techniques can eventually be successfully applied to this problem.

Many hypotheses concerning the pigment-vehicle interface and the immediately surrounding area would be subject to searching examination if this next step in the potential of the electron microscope is achieved. And this advance might be one of technique rather than an increase in the resolving power of the instrument.

Innumerable questions regarding these thin chemical coatings we call paints remain unanswered. Increased use of the electron microscope could provide much information and allow many practical and definitive conclusions concerning the initial structure and the aging processes of paint films.

Chiefs and Indians

IT is hardly a profound observation on my part—rather the natural inclination of *homo sapiens* to give particular weight to an opinion which agrees with one's own. And this truism is reinforced when the thought is not only unique but also carries the emphasis of an expert. An explanation is now offered for the tremendous in-

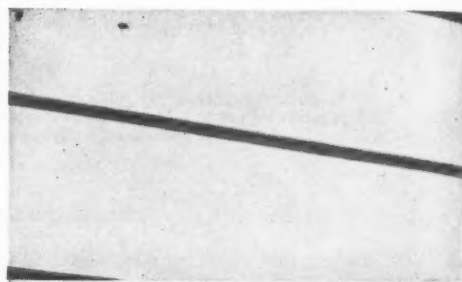
crease of "high-level manpower and the greater employment of brain power everywhere in our economy," which removes this fact from the problem area and into the realm, not only of the *fait accompli*, but of actual necessity. Professor F. H. Harbison's "More Chiefs, Fewer Indians" (*Princeton Alumni Weekly*, Oct. 21, 1960), states his new "Harbison's Law" that "administrators, managers, engineers, scientists and other high-level functionaries are bound to multiply in any dynamic and progressive organization, and failure to do so is a manifestation of a

creeping stagnation, which is an indication of backwardness."

Comparative figures are enlightening: "In an underdeveloped Country such as Nigeria... high-level manpower category would constitute less than one-tenth of one per cent of the population. ... In Ghana, which is somewhat more advanced, ... three-tenths of one per cent. ... in Egypt five-tenths. ... In the U.S.A. or the Soviet Union, five per cent of the population. ..."

According to Harbison, *innovation* is the prime force behind this change. Technological innovation

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You can get these benefits with new ONCOR T15 lead silico titanate pigment...

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T15 is the newest member of the ONCOR pigment line. With particles consisting of silica cores enclosed in shells of lead titanate (long-recognized as an excellent

pigment) — ONCOR T15 promotes film integrity, color stability and general durability of tinted paints. →

The following house paint tint-base formulations are suggested as examples

which have been found by test fence exposure to be of excellent quality:

HOUSE PAINT TINT-BASE FORMULATION FOR MEDIUM AND DEEP COLORED HOUSE PAINTS

Pigment	T-10669	Pounds	Gallons
ONCOR® T15 (lead silico titanate pigment)		300.00	8.90
Zinc oxide, acicular		250.0	5.32
Magnesium silicate		150.0	6.30
FOAM-A® (barytes)*		250.0	6.75
BENTONE® 38 (gelling agent)		3.0	0.20
		953.0	27.47
Vehicle			
Methanol/water (95-5%)		0.9	0.13
Linseed oil, raw		360.0	46.63
Linseed oil, pale heat bodied, Z2 visc.		120.0	15.0
Mineral spirits		75.0	11.44
Liquid drier		20.0	2.90
		575.9	76.10
		1528.9	103.57
	TOTALS		

PVC: 30.83% • Weight per gallon: 14.76 lbs. • % Vehicle: 36.67.
Consistency: 88 KU • % Pigment: 62.33 • % Volatile in vehicle: 16.65.
*National Lead Company, DeLore Division, St. Louis, Missouri

The above data have been developed in our laboratories and are believed to be correct.

T15 an **oncor**® Pigment... A Development of

—the introduction of new products and processes, and organizational innovation — new administrative units and systems of management, have “affected the occupational structure of entire industries,” and are “associated primarily with dynamism and progress” in the “development of man.”

Reinforcing this thesis is a recently released study by the American Iron and Steel Institute, which indicates that the proportion of salaried employees in the steel industry has increased from ten per cent in 1935 to 22 out of every 100 employees in 1959.

The consequences of the basic economic and technological forces

which are at work in modern society have had deep and far reaching effects on the whole fabric and structure of existence. Within this broad evolving framework the need and utilization of high-talent manpower—the *uncommon* man, the *atypical* being—are obviously of increasing importance. Thus there is a problem of forward manpower planning (*qualitative* as well as *quantitative*) as well as consideration of the changing “hierarchical relationship between positions in an enterprise which may have to be completely overhauled as old skills become obsolete and new ones rise in strategic importance.”

Harbison concludes: “In the

future, the really practical approach to manpower problems may be the theorizing approach. In this age of accelerated innovation, the dreamer may be as important as the doer. Certainly, the neglect of forward planning is an invitation to future disaster in the modern century of science.”

This, then, is part of the *New Frontier*.

13 to 15 Per Cent

The numbers game is always fascinating. And doubly so when it puts into perspective another facet of the technological function within the corporate structure. *Chemical Week* (Nov. 26, 1960) reports some details of an American Management Association survey covering 88 companies, concerning the distribution of employees according to seven categories. These are, in descending numerical order, 1) manufacturing or processing, 2) designing, creating, developing, researching, 3) marketing, 4) general administering, 5) specific accessory functions, 6) extracting or producing, and 7) transporting.

The average of employees engaged in the third function ranges from 13 to 15 per cent in the nine chemical, eight drug, and 71 manufacturing companies surveyed—a surprisingly narrow variance for such diverse enterprises. This category would include the personnel of the research, development, and customer service laboratories of paint companies. The proportion could serve as a guide when evaluating the distribution in one's own company—and the relative position of, and emphasis on, chemists and engineers.

John Musser to Head Pittsburgh Paint Group

The Pittsburgh Paint, Varnish and Lacquer Assn. announced the election of John R. Musser, Pittsburgh Plate Glass Co. as Incoming President for the year 1960-61. Mr. Musser had previously served two terms each as Vice-President and Treasurer of the Association.

Other newly elected officers include E. R. Coyle, Vice-President, J. K. White, Secretary and Francis H. Fry, Treasurer. All three have previously served the Pittsburgh Paint, Varnish and Lacquer Assn.



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Specific gravity	4.05	Hiding power (complete over black and white sq. ft./lb.)	30
Weight per gallon—pounds	33.7	Retained on #325 Mesh Sieve, %	0.3
Oil absorption—(gms. per 100 gms.)	30	Lead oxide (PbO), %	43.0
Color	Off white	Silicon dioxide (SiO ₂), %	42.0
Tinting strength	200	Titanium dioxide (TiO ₂), %	15.0

HOUSE PAINT TINT-BASE FORMULATION FOR LIGHT-TINTED HOUSE PAINTS

Pigment	T-10670	Pounds	Gallons
ONCOR® T15 (lead silico titanate pigment)		300.0	8.90
Zinc oxide, acicular		250.0	5.32
Magnesium silicate		150.0	6.30
FOAM-A® (barytes)*		200.0	5.40
TITANOX RA-NC***		50.0	1.43
BENTONE® 38 (gelling agent)		3.0	0.20
		953.0	27.55
Vehicle			
Methanol/water (95-5%)		0.9	0.13
Linseed oil, raw		360.0	46.63
Linseed oil, pale heat bodied, Z2 visc.		120.0	15.00
Mineral spirits		75.0	11.44
Liquid drier		20.0	2.90
		575.9	76.10
TOTALS		1528.9	103.65

PVC: 30.89% • Weight per gallon: 14.75 lbs. • % Vehicle: 37.67.

Consistency: 86 KU • % Pigment: 62.33 • % Volatile in vehicle: 16.65.

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Relative Evaporation Rate (n-Butyl Acetate = 100).....	45
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% Relative Humidity, \approx 2%.....	89
Brookfield Viscosity of Vinyl Formulations	
Formula A*	
At 68°F. (centipoises).....	308
18 hours at 24°F., 5 hours at	
68°F. (centipoises).....	412
Formula B**	
At 68°F. (centipoises).....	360
18 hours at 24°F., 5 hours at	
68°F. (centipoises).....	850
Relative Viscosity at Alkyd Resin (xylene = 100).....	84
Pounds per gallon at 20°C.....	6.77

*Formula A: 20% BAKELITE Vinyl
Resin VYHH
80% Methyl Isoamyl
Ketone

**Formula B: 20% BAKELITE Vinyl
Resin VYHH
40% Methyl Isoamyl
Ketone
20% Xylene, 20%
Toluene

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XX-600	Medium	Acicular	105
XX-620 (Densified)	Medium	Acicular	105
XX-50	Medium	Nodular	115
XX-501 (Densified)	Medium	Nodular	115
XX-2	Fine	Nodular	130
XX-55	Fine	Nodular	140
XX-601	Medium	Acicular	160
XX-621 (Densified)	Medium	Acicular	160
XX-602	Fine	Acicular	220

Fast wetting is, of course, a relative term. It should always be related to consistency. And it is so used here. Each HORSE HEAD zinc oxide in this newly improved line is fast wetting compared with conventional oxides of the same consistency.

- *A Complete Range of Consistencies*
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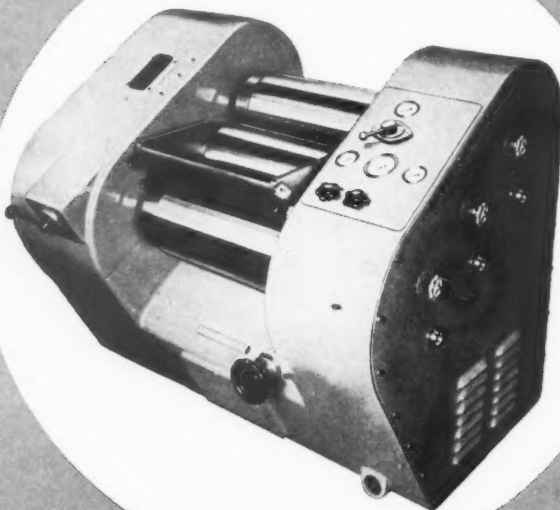
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Roll Dimensions: 10" x 20"

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16" x 40"



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A constant goal of the plant manager is higher production rates, requiring optimum performance of both the individual and the organization. For an interesting study on how managers can achieve greater productivity and efficiency among his workers, see page 63.



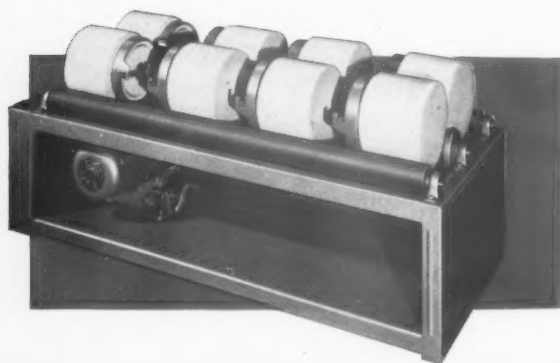


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Laboratory Jar Mills have been vastly improved over the past few years. And U. S. Stoneware has led the way with a host of advanced design features that add up to speedier, more convenient, lower cost milling.

If your equipment is in the category of the obsolete unit above, it will pay you to investigate the broad "U.S." line. Modern "U.S." Jar Mills are rugged, efficient, easier to operate. They're designed to provide maximum capacity and flexibility in minimum floor space. Standard "Unitized" models require little floor space, have patented "no-creep" rolls that automatically keep jars centered. "U.S." Long-Roll units offer even greater space savings—permit you to expand milling facilities in the same floor area occupied by other models.

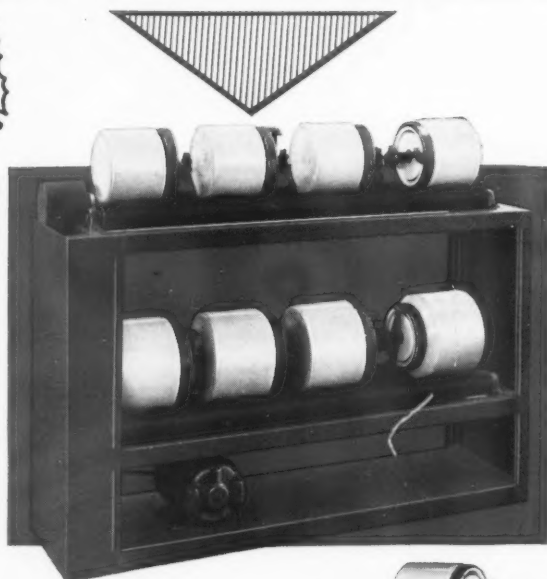
Check the wide range of types and sizes available to modernize your milling operations now. Write for Bulletin JM-290.



PROCESS EQUIPMENT DIVISION

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Above: Fig. 802D 2-Tier Long-Roll Jar Mill with 2 parallel rolls; handles jars 2" to 15" in diameter.

Right: Fig. 784 3-Tier "Unitized" Jar Mill has exclusive "self-centering" rollers; handles jars 2½" to 13" in diameter.

Left: Fig. 901DV 1-Tier Long-Roll Jar Mill has 3 parallel rolls; variable speed drive; rolls jars 2" to 15" in diameter.



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You can keep grinding jars separated and positioned exactly where you want them on any long-roll mill with patented "U.S." Jar Positioners. Made of long-wearing hard rubber, simple to install, can be quickly moved to any position.



IMPROVING MANAGERIAL PERFORMANCE

By

Lawrence Shatkin

THE challenge of a manager is to achieve optimum performance through the effective use of the resources at his disposal. This optimum performance must be a joint goal of the individual and the organization. It transcends more efficiency and focuses on effectiveness, which includes economic and social criteria toward common goals for the organization, the individual and society.

Traditional Theory

The measurements of managerial accomplishments are often described as earnings, return on capital investment, increased sales, production costs, etc. While these yardsticks are important, and perhaps vital at times, there are other factors which I believe influence the results we are striving for. Initially, these might be considered intangibles, which are incapable of measurement. However, factors such as attitudes, loyalty, communications, motivations, decision making, group interaction, leadership, etc. are being studied, and inferences and conclusions can be drawn from the research work of the social scientists. All these measurements concern human behavior.

Increased Productivity

The managers who have a favorable attitude toward men usually

have a higher producing unit. These managers avoid becoming job-centered, and encourage their group to set their objectives, and allow their men to participate in establishing these objectives. These managers believe in enlarging the job to correspond to the individual's abilities.

In contrast, the pressure-oriented manager uses his men as a means for attaining his own objectives without considering the values and subjective feelings of his men under him. Invariably, these men do not become a well-knit team and usually are on the lower scale of producers.

Standards of Performance

The effective manager must develop skill in helping his subordinates set standards of performance. They are formed and nurtured around the concept "management by objectives". This approach requires the subordinate to give careful thought to his goals and those of the company and learn to integrate both of them. The individual must learn to set-up priorities, target dates for completion, and distinguish long and short range programs. The subordinate is encouraged to indicate those factors which stifle his performance. This enables the individual to think about his own strength and weaknesses, and become self-directing through his own analysis and judgment.

Coaching Role

The manager must develop skill in coaching the line organization regarding these standards. His primary purpose is to help the person improve his performance by converting the subordinate's plans and target dates into reality, and integrate the individual's objectives with those of the company. The coaching process builds a relationship in terms of human understanding, getting away from the traditional technique of analyzing mere production and sale statistics. In essence, this becomes an analysis of one's self-appraisal. This program indicates the development of a mature philosophy of management which embraces the thinking and workings of the social scientist.

An Improved Production Form

Below are depicted two production forms which are simple in design. Figure 1 shows entries for daily production and a column for cumulative totals. However, it does not have any diagnostic value. In fact, it could conceivably be misleading without such intent. It does not communicate any aspect of human behavior.

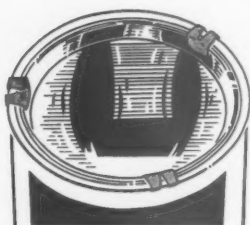
The form in figure 2 is merely an extension of the previous one, and attempts to tell a story. It suggests a "we" approach and stresses that the productivity recorded is a measure of everyone's performance, by correlating the man-hours worked, the production achieved, and the number of men absent. It informs all the employees that performance is the concern of everyone, and pushes the responsibility downward, where it belongs.

Management Development

Managers can learn to manage best by managing. It is necessary to translate management information into management skills. However, it is first necessary for a company to evolve a sound concept of management, whose success will be reflected in the performance of its personnel. Any such program will focus on the future, and not endanger long-range plans for short-term expediency. Management development in the final analysis is self-development, and the recognition of the need for growth ushers in the beginning of personal de-

The opinions expressed in this feature are not necessarily those of any particular firm or organization.

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HOUSE PAINTS

LATEX-EMULSIONS

FRANKLIN MINERAL PRODUCTS

COMPANY
FRANKLIN, NORTH CAROLINA
INCORPORATED 1926
Agents in Principal Cities

MONTHLY PRODUCTION

Goal _____ gals.

Date	Daily Production	Total Production (in Gals.) to Date

Totals

Total Batches _____
Aver. Gals./Batch _____
Aver. Batches Daily _____
Aver. Gals. Daily _____

Figure 1

PRODUCTIVITY — A MEASURE OF OUR PERFORMANCE

Month _____

Goal _____ gals.-filled
man-hour

Date	Daily Production	Weekly Production	Weekly Man-Hours (Including Overtime)	Weekly Productivity Gals. Filled/ Man Hr.	Daily Number of Men Absent	% of Work Force

Totals

Total Batches _____
Aver. Gals./Batch _____
Aver. Batches Daily _____
Aver. Gals. Daily _____

Figure 2

velopment. Management must direct its program toward the kind of work it expects managers to perform in managing.

Management Attitude

The managerial attitude best able to cope with the elements of risk through performance is always achieved by the manager who asks himself, "what do I have to contribute upward?" His thinking should be directed upward since he is the one responsible to think things through. This requires a conscious, deliberate act of changing one's direction when necessary. This also requires that the manager have the ability to plan and organize. It is also necessary that

the manager have an understanding about behavior couched in the self-concept, defense mechanisms, motivation, and the factors involved in change, and impart these concepts to his supervisors.

There aren't any conclusions in this field because we know so little of the functions of "top management". There are new frontiers of management which the manager must struggle with in the immediate years ahead. These frontier areas concern the complex field of human motivations, the area of long-range planning, and the area of organizing, communicating and using information for decision-making.

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AZODOX high apparent density zinc oxides



You can store AZODOX in much less warehouse space than required by other zinc oxides. Reason is, you get many more pounds of AZODOX per cubic foot of pigment, up to 65 lbs./cu. ft.! And smaller bags handle easier, faster—stack higher safely—reduce breakage losses—are shaped to give close-packed, unitized shipments.

In the manufacture of AZODOX, an exclusive process removes excess, space-wast-

ing air from between individual particles of zinc oxide. That's all! Actual pigment density and all other desirable properties are unchanged. In comparison with other zinc oxides, high apparent density AZODOX flows freely yet dusts less, increases mixing capacity, disperses readily.

You can get high apparent density AZODOX in five grades of AZO brand lead-free paint pigments: acicular or nodular particle shape. For technical data, just fill in and mail this coupon.

*Pallet load of AZODOX on left above is 30.4 cu. ft. Pallet load of regular zinc oxide on right is 44 cu. ft. Same number of bags; same weight... *but a 30 percent saving in space!*

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NEW EQUIPMENT AND MATERIALS

This section is intended to keep our readers informed of new materials and equipment. While every effort is made to include only reputable products, their presence here does not constitute an official endorsement.



PATTERSON FOUNDRY

VARIABLE SPEED AGITATOR Fixed Speed Motor

"The Wizard," a new portable agitator which delivers speeds of from 260 to 4000 rpm from an explosion proof, single-speed motor has been introduced.

Providing all the advantages of variable-speed portable agitators, at only slightly more than the cost of conventional fixed-speed portables, the Wizard produces output speeds over a 9 to 1 range. A turn of the handle allows immediate speed adjustments in the 260 to 2400 rpm range. Speeds as high as 4000 rpm can be achieved simply by changing one V-belt and driven pulley.

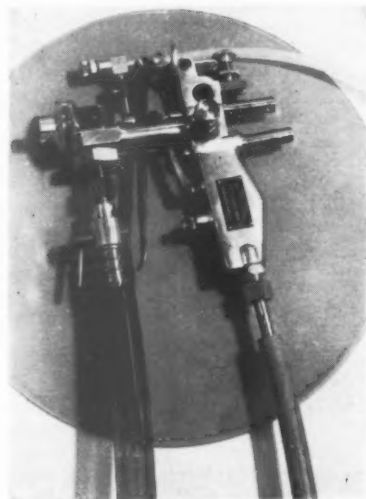
This new unit is recommended by the manufacturer for dispersing paint pastes, thinning and tinting paints, and a range of other mixing jobs.

Standard features of the agitator include: a 2 hp, 1750 rpm explosion-proof motor; 1" diameter

stainless steel removable agitator shaft; dispersion disc impeller of patented design; and cast aluminum double clamp bracket—with ball and socket joint and lever-operated clamp allowing vertical and sidewise angle adjustment. Optionals include 4-bolt mounting plate in place of the clamp; quick-release chuck for easy shaft removal; lower horsepower motors.

The 5 hp agitator was operating speed ranges of 380 to 1500 rpm and 550 to 2200 rpm.

The Patterson Foundry & Machine Co., Dept. PVP, East Liverpool, Ohio.



NAFTONE

SPRAY GUN One and One-Half Pounds

"Zippel" two-component catalyst gun, features a unique spray nozzle which is a small pipe centrally located within a larger pipe. There is no opportunity for ingredients to mix in the gun as blending takes place outside of the nozzle tip. The spray gun is precision made and weighs only one and one-half pounds which makes it easy to use for prolonged periods.

A visible feed system gives positive proof that the proper ratio of

polyester to peroxide is accurately maintained. Air pressure is used over the two-components to assist flow to the spray gun. This allows the use of thixotropic and pigmented finishes and makes it possible to use lower air pressure at the gun. Adjustments are easily made at the gun to insure proper feed.

Other catalyst systems can be used in the apparatus as well as polyesters. The whole equipment can be made portable as an inexpensive rack with wheels will suffice.

Naftone, Inc., Dept. PVP, 425 Park Ave., New York 22, N. Y.

CONTINUOUS MIXER High Shear Action

New shear-flow continuous mixer has been specifically designed to provide high shear action in continuous mix operations. Incorporating the same design principle as the portable shear-flow, the new continuous mixer is capable of mixing any liquid that can be pumped, with results better than or comparable to that of equipment



GABB

costing considerable more. The relatively small RL Hi-Shear mixing head is enclosed within a sealed chamber that contains an inlet for the introduction of material and an outlet for the passage of the finished mixture. Being a completely sealed

**NEW
MATERIALS — EQUIPMENT**

unit, the Shear-Flow eliminates the possibility of air entrainment and is ideal for use on pressure systems, inversion applications, introduction of gasses to liquids and enables inflammable materials to be used with complete safety. This compact and completely self-contained unit conserves space, eliminates large mixing and paddle tanks and conveniently lends itself to systems requiring jacketed heating or cooling. In applications where an exceptionally fine blend at a high rate of flow, or the introduction of different materials must be made separately and at specific times along the route of flow, more than one shear-flow unit can be installed in series to accommodate such process requirements.

Gabb Special Products, Inc.,
Dept. PVP, Windsor Locks, Conn.

**COATING SYSTEM
Readily Pigmented**

Two-component coating system with very high mar and chemical resistance has been developed.

Designated "Aroflint Two-Component System 505," the coating is designed for floor, furniture, paneling and marine finishes, primers, factory finishing of construction materials, and other industrial and trade sales applications where durable, high gloss coatings with excellent color retention and toughness are required.

In many respects the system surpasses epoxy, urethane and polyester coatings. Its advantages over these include: Outstanding color retention compared with epoxy and urethane finishes, excellent adhesion to most surfaces, including metal, wood and cement, excellent flow that develops high gloss, pot-life of 16 to 48 hours, easily adjusted by varying proportions of two components to produce hard and tough or very flexible and slick-surfaced coatings, very high solids obtainable at application viscosities, and can be air-dried, forced-dried or baked.

With the system, the ratio of the components, Aroflint 202 and Aroflint 303, can be varied to obtain differing degrees of adhesion, hardness, flexibility, gloss retention and

other physical properties. A 50-50 mixture by weight, on a solids basis, provides optimum hardness and chemical resistance.

The pot-life of the coating system after blending varies from 16 to 48 hours, depending on total solids, type of solvents used to reduce to a desired application viscosity and temperature. Aromatic and ester type solvents are excellent reducing solvents.

Archer-Daniels-Midland Co., Resin Div., Dept. PVP, Minneapolis 2, Minn.

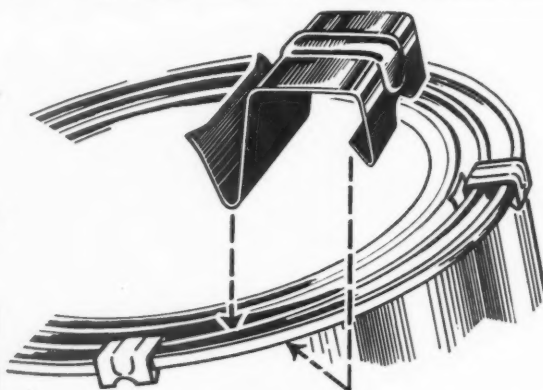
**IMMERSION DRUM WARMER
For 55-Gallon Drums**

An immersion-type drum warmer, designed for standard 55-gallon drums, has been announced.

The immersion unit, designed for rapid heating of materials in 55-gallon drums, consists of a heat transfer unit, rolled to the proper diameter to fit the contour of the drum wall. It is available in either serpentine or header construction, with inlet and outlet connections outside of the drum.

Platecoil Div., Tranter Mfg., Inc., Dept. PVP, 735 E. Hazel St., Lansing 9, Mich.

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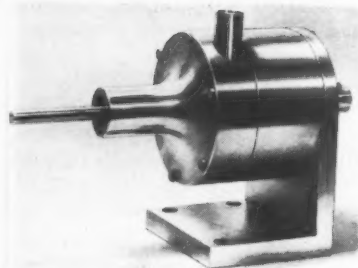
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NEW MATERIALS — EQUIPMENT



HOBAM

SHEAR PUMP Emulsifies, Fortifies and Blends

New type of continuous flow mixing pump has been introduced. Highly versatile, this shear pump can be used on a wide range of products in all processing industries from dairy to chemical processing. It is designed to provide positive continuous blending of wet with wet or wet with dry products. Capacities range from 5 GPM (laboratory unit) to 200 GPM (production unit).

The shear pump consists of a combination of rotors and stators which may be varied in any number of combinations depending upon the product requirement. There are a minimum of 750,000 cuts per minute so that continuous operating can replace batch mixers. There is no aeration, although it can be incorporated into the unit if it is desirable. The shear pump's low horsepower is converted to optimum operating efficiency with virtually no heat gain in the product. Controlled "dwell time" for maximum uniformity of particle size is achieved by a control valve on the pump outlet line. A wide range of rotor types in single, double or triple stage units operable at variable RPMs is available. These units may be cleaned-in-place and quickly disassembled for fast, easy maintenance. The operation is smooth and without vibration. Once the product setting is determined, this Shear Pump cannot overwork the product. The intimate blending feature is combined with a built-in centrifugal pumping action that develops a suction lift and a discharge head.

Hobam Inc., Dept. PVP, P. O. Box 91-133, Buffalo 17, N. Y.



The LEHMANN VORTI-SIV

. .small size, tremendous output

This screening machine is unique in that its gyratory action is adjustable both in speed and radius of gyration. When the optimum relationship between these two factors is reached throughputs are multiplied.

In four square feet of floor space, therefore, the Vorti-Siv gives production that would require many times that area in

any other type of screening machine. The unit has casters, making it easily movable from one location to another.

The Vorti-Siv processes powders, liquids and slurries in meshes from 4 to 400 which can be changed quickly. The screen is practically non-blinding and cleanup takes only a few minutes.



Write for full information and a free trial run of your product — or contact the nearest Lehmann distributor.

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Harry Holland & Son, Inc.
10500 Puritan Avenue
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Geo. R. Mellema Co.
620 Plymouth Building
Minneapolis 3, Minnesota

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3330 Peachtree Road, N.W.
Atlanta 5, Georgia

The Moore Drydock Co.
Ft. of Adeline Street
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220 E. Missouri Avenue
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Rawdon Myers Agency
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601 West 26th Street
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See our advertisement in Chemical Engineering Catalog

N E W
MATERIALS — EQUIPMENT

VINYL FINISH
Dries in 15 Minutes

Quick-drying interior vinyl finish, said to be eight per cent longer-lasting than other vinyl finishes and 14 per cent more durable than top-grade paints and varnishes, has been introduced.

Marketed under the trade name "Gay-Lon," the new product is similar in application to the company's older vinyl finish, also labeled Gay-Lon.

Designed to give an extremely durable surface to floors and furniture, the plastic-base finish dries to a soft satin gloss in 15 minutes. It may be thinned with turpentine or

mineral spirits. For well-traveled floors, a second coat is recommended, applied two or three hours after the first.

According to the manufacturer, Gay-Lon can be applied directly over most old finishes—varnish, paint, lacquer or shellac—without fear of lifting. It may be brushed, rolled or sprayed on; is available in quart, gallon and five-gallon cans and 12-oz. aerosol containers; and covers about 400 square feet per gallon.

Seaboard Lacquer Co., Dept. PVP, Baltimore 15, Md.

VOLUMETRIC FEEDER
Belt-and-Gate Design

New volumetric feeder, the "Merchen Volumetric," measures all

free-flowing powdered, granular, or lumpy solids by volume, and has a maximum capacity of 3600 cubic feet per hour.

The new feeder is reported to be the only volumetric feeder with belt-and-feed-gate design. Models are available with 9" or 18" Buna-N feed belts. The small model feeds from 0.1 to 600 cubic feet per hour; the 18" model, from 0.6 to 3600 cfh. Depending on the density of the material fed, this is the equivalent of 3 to 3000 lbs. per minute.

Feed rate is adjustable by a simple dial setting over a 10:1 range. Accuracy is maintained within $\pm 3\%$ over any one-minute period. Belt speeds may be changed by means of a two-speed gear box, to give a 100:1 range. A variable speed drive, available on the 9" model only, increases range to 1000:1 when combined with the two-speed gear box.

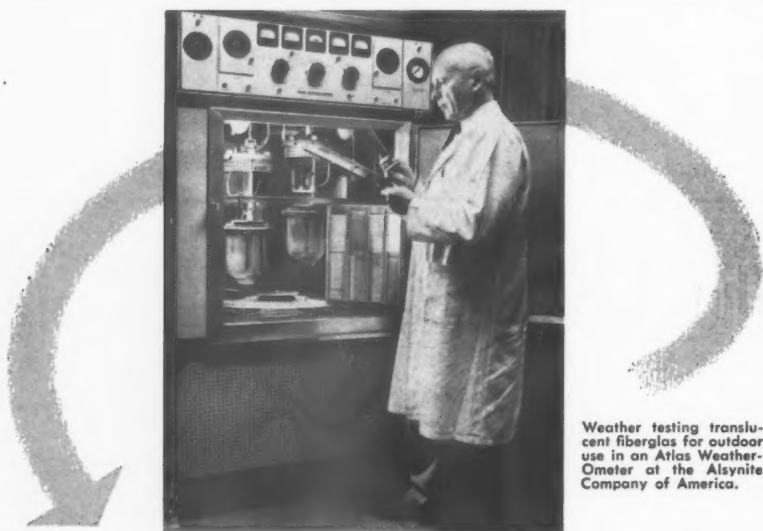
Overall feeder construction is of aluminum, with the vertical gate made of stainless steel. Stainless steel can also be supplied in the feed section to avoid any danger of contamination.

The design of the feeder offers two additional advantages. Either size can be converted to a gravimetric feeder by adding weighing components. And an optional off-feed switch stops the feeder or actuates an alarm when feed falls below a selected rate.

Wallace & Tiernan Inc., Dept. PVP, 25 Main St., Belleville, N. J.

LATEX HOUSE PAINT
Repainting without Primer

Using a new, exclusive formulation, has introduced improved chemistry which makes it possible to repaint exterior surfaces with latex paint without first applying a prime coat. Called "Acrypolyrene House Paint," the next exterior finish not only eliminates the need for oil or latex primers on previously painted surfaces, but also combines advantages superior to those previously associated with latex paints. User benefits include smooth, effortless application; better hiding power; less-than-an-hour drying time; uniform, tough finish that lasts longer, holds its color more years; successful application when surfaces are damp from dew or rain; quick cleanup with soap and water; no need for linseed oil or turpene-



Weather testing translucent fiberglass for outdoor use in an Atlas Weather-Ometer at the Alsynite Company of America.

Weathering Qualities of Paints *can be pre-determined with speed and accuracy in the* **WEATHER-OMETER®**

The natural weathering effect of sunlight, moisture, thermal shock and rain is reproduced on a highly accelerated basis in the Weather-Ometer. The cycle to be used is controlled by the Cycle Meter which automatically regulates the length of the exposure to light and moisture under controlled conditions of temperature. Available with automatic control of relative humidity permitting exposures under conditions simulating the formation of dew.

Results are positive and dependable and any test program can be duplicated or repeated at any time.

A few of many users of
Atlas Weather-Ometers:

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Ford Motor Company	Pratt & Lambert Inc.
Harrison Paint &	Pittsburgh Plate Glass Co.
Varnish Co.	General Electric Co.
John Lucas & Co., Inc.	E. I. DuPont de Nemours
Rust-Oleum Corp.	& Co., Inc.
Benjamin Moore & Co.	Glidden Co.
Reardon Co.	Cook Paint & Varnish Co.
	Sherwin-Williams Co.

ATLAS ELECTRIC DEVICES CO.
4114 N. Ravenswood Ave., Chicago 13, Illinois U.S.A.

**NEW
MATERIALS — EQUIPMENT**

time. Another major innovation from the firm is a compatible companion latex product, "Acrypolyrene House Paint Primer," which serves as the perfect emulsion foundation for new wood surfaces. Providing dealers with a complete emulsion system for the first time, the new Luminall latex combination offers substantial cost and time saving appeal to the market until now dominated by oil-type outside paints.

Luminall Paints, Dept. PVP,
3617 S. May St., Chicago 9, Ill.



FEDERAL PACIFIC

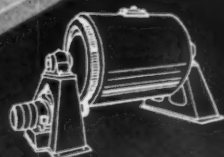
**PRECISION BALANCE
Strong Construction**

New precision balance called the "Model L Precision Balance" has been introduced for rapid precise weighings in the fields of research, production, quality control, and analytical work.

The new balance, which is of double hook design, fills weighing needs in a range as low as 0-3 mg or as high as 0-50 grams. By means of its counterweighing ability, loads up to 3 times scale value can also be weighed.

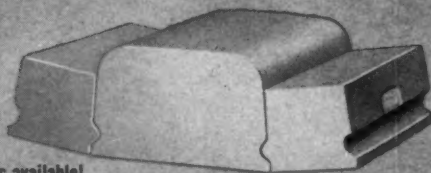
The balance's applications in weighing, counting by weighing, and production weighing operations can be numbered in the thousands. Botany labs, chromatography, cotton fiber weighing, denier checks, endocrine gland weighing, glass preforms, moisture tests, pharmaceutical testing, soil laboratory, surface tension testing, textile research, wool stapling, cigarette weighing, cathode weighing, geochemistry, hormone assays, microbiology, sodium extrusion weighing, spectro-

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in
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The longest and gentle feature in ARLCITE balls is a unique interlocked, tightly keyed design with narrowest cement joints. For further information on ARLCITE balls and blocks, write for bulletin.

PORCELAIN DIVISION

FERRO CORPORATION
East Liverpool, Ohio

NEW MATERIALS — EQUIPMENT

graphic preparations, cosmetics, seed weighing—these are but a few.

The new balance has a net weight of only 10 lbs. Supplied with each instrument is a newly designed carrying case which allows it to be transferred easily from place to place.

Federal Pacific Electric Co., Dept. PVP, 50 Avenue L, Newark 1, N. J.

DISSOLVERS Stationary Mounted

New, variable-speed dissolvers, designed for mounting on fixed tanks and applicable to a wide variety of mixing problems, are announced.

The variable-speed drive mechanism is capable of delivering 90% of motor horsepower to the impeller even at lowest speeds, regardless of changes in material or viscosity. Speeds may be easily changed without stopping the machine.

Ranging up to 40 horsepower in size, these high-speed, high-shear, impeller-type mixers may be mounted on almost any stationary tank anywhere.

Applications include general mixing operations, dissolving, emulsifying and de-agglomerating. Materials which may be processed include solid-liquid, liquid-liquid and gas-in-liquid formulations. Viscosities up to 50,000 centipoises or more can be easily handled.

The new units are especially suitable for meeting special mixing problems that require sealed tanks to avoid vapor loss. They also can be easily adapted for use in vacuum and pressure tanks. They may be operated at high speed in original processing and then slowed down for simple agitation or to keep materials in suspension when desirable.

Due to relatively high-speed operation, the units are correspondingly compact and lightweight and produce large volumes in small space. Impellers are non-clogging and self-cleaning.

Morehouse-Cowles, Inc., Dept. PVP, 1150 San Fernando Rd., Los Angeles 65, Calif.



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your product
and—
"We add the
spray, take
nothing away"

Sprayon

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CUSTOM LOADER
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Complete facilities for all types of pressurized product development and production. Hot and cold filling, long and short runs. Our production work is unconditionally guaranteed.

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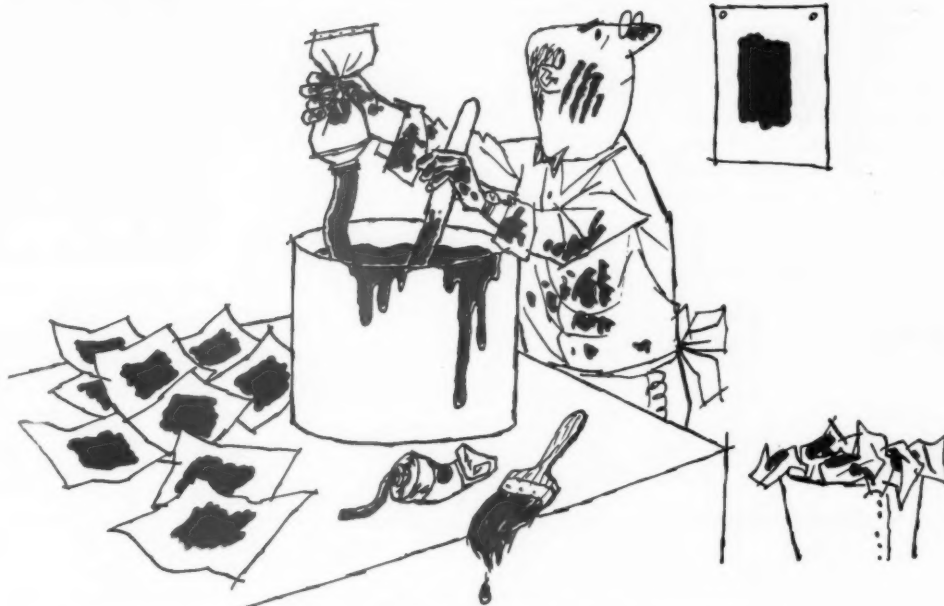


THE CALIFORNIA INK COMPANY, INC.
Raw Materials Department
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Portland, Seattle.....	The W. Ronald Benson Co.
Tampa (Indian Rocks), Florida.....	A. J. Passonne
Houston.....	Cron Chemical Corporation

HOW TO MAKE YOUR OWN COLORANTS



DO SOMETHING ABOUT COLOR CONTROL...
or establish Cal Ink's 14 basic controls,
if you really want quality and uniformity

This is rather costly and time-consuming—as Cal Ink well knows.

But as color specialists, we also know we can't take chances.

There are more than 25 people in our quality control laboratory making constant checks of incoming raw materials—checks during manufacture of basic dry colors...during manufacture of vehicles...

and during manufacture of color dispersions to assure uniformity of color, of tints and of color development when intermixed.

Still more controls make certain after manufacture that Cal Ink colorants will develop properly in a wide range of base paints.

You can save real money and still make sure of the finest quality and uniform colorants by writing, calling or wiring the color specialists:
**The California Ink Company, Inc., Raw Materials Department • 545 Sansome Street,
San Francisco—or the nearest representative listed at left.**

← Ask your Cal Ink representative for a complete booklet of these "helpful hints."

NEW
MATERIALS — EQUIPMENT

**RED-VIOLET PIGMENT
For Industrial Finishes**

A new quinacridone pigment with a brilliant red-violet hue, "Quindo Magenta RV-6803," is now available for use in automotive and other industrial finishes, printing inks, vinyl products, plastics, and textile printing inks.

The pigment will give fiery red shades with molybdate orange, clean pastel tones with titanium dioxide, bright iridescent red-violet shades with nonleafing aluminum, and brilliant yellow-toned iridescent maroon colors with aluminum and

gold paste or other yellow and orange pigments.

Coatings made with Quindo Magenta RV-6803 in five different vehicles were put through exposure tests in Florida and found to have good color retention.

Quindo Magenta RV-6803, for all practical purposes, is non-bleeding in automotive and industrial finishes and textile ink applications.

Other Quindo Magenta pigments include "Resinated Quindo Magenta RV-6804" for easier dispersion in printing ink and plastic applications and "Quindo Magenta Presscake RV-6813" for resin flushings, water dispersions, emulsion paints, and textile emulsion printing inks.

Allied Chemical Corp., National Aniline Div., Dept. PVP-P.R. 88, 40 Rector St., New York 6, N. Y.

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T. F. Washburn Co., Dept. PVP, 2244 Elston Ave., Chicago 14, Ill.

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The new thickener can be added to paint as easily as sugar can be added to coffee. When mixed with a small quantity of water, Cellosize QP-15,000 forms a smooth, fluid slurry that will not begin to thicken for ten to fifteen minutes. It can be added to the pigment grind or at any other convenient stage in the paint formulating operation.

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Hot water or steam at pressures to 125 psi (or refrigerant, if cooling is desired) is introduced into the single-embossed panels, circulating through the series of flow channels and out, transferring the heat efficiently to (or absorbing it from) the drum.

This arrangement permits the drum to be held in position indefinitely, yet removed and replaced quickly. Rigid or flexible piping to the Panelcoils may be permanent or easily disconnected if the equipment is to be moved about the plant. There is no fussing with hardware or danger with electrical connections.

Dean Products, Inc., 1048 Dean St., Dept. PVP, Brooklyn 38, N. Y.

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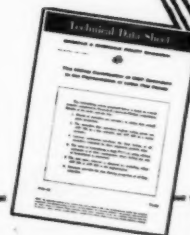
THIS STUDY (T.I. 213) SHOWS:

- ... that a blend of properly chosen extenders gives the best overall paint properties.
- ... that formulating to high PVCs with certain extenders may not be the economical way to good hiding.
- ... that a blend of ASP 200 as a fine extender and ASP 400 as a coarse extender contribute highest hiding power.

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PATENTS

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired (to foreign countries \$1.00 per copy) to the publisher.

Latex Paint With an Esterified Polyether Modifier

U. S. Patent 2,965,590. Edwin F. Schumacher and Leslie B. Stokes, Louisville, Ky., assignors to Devco & Reynolds Co., Inc., a Corp. of N. Y.

In the production of interior and exterior aqueous emulsion polymerized

paints to form latex paints containing latices of the group consisting of polybutadiene, polyvinylchloride, polyvinylacetate, polyacrylonitrile, polyethylene, polystyrene, polymethylacrylate, polyvinylchloride, butadiene-styrene, vinylidenechloride-vinylchloride, polymethyl methacrylate and acrylate esters, the improvement in latex paints to be applied to surfaces of the type of porous substrates subject to weathering, chalky surfaces, and masonry surfaces which deteriorate latex paint due to leachable salts, which improvement comprises dispersing in said latex paint a modifier comprising a solution of a higher unsaturated monobasic acid ester of a polyether selected from the group consisting of epoxy alkyl and hydroxyl alkyl phenyl polyethers having terminal substituents selected from the group consisting of hydroxyl and oxirane radicals and from 0.5 to 8 weight percent based

on the ester of a surface active agent selected from the group of non-ionic and anionic surfactants having HLB values in the range of 8 to 20 and miscible with the ester solution to the extent of at least 0.5 percent, the amount of modifying composition being such that from 2 to 40 weight percent of the ester is present in the paint based on the total paint weight.

Carboxy-Copolymer Epoxide

U. S. Patent 2,965,602. Darrell D. Hicks, Louisville, Ky., assignor to Devco & Reynolds Co., Inc., a Corp. of N. Y.

A thermosetting resinous composition comprising in admixture (1) a glycidyl polyether of a polyhydric compound selected from the group consisting of polyhydric alcohols and phenols having at least two phenolic hydroxyl groups; (2) a butenedioic acid ester of a polyethylene glycol having the formula $\text{HOOCRC}=\text{CRCOOCH}_2$

$(\text{CH}_2\text{OCH}_2)_x\text{CH}_2\text{OOCRC}=\text{CRCOOH}$ wherein R is selected from the group consisting of hydrogen and methyl substituents and x is a whole number such that the polyethylene glycol has a weight of 200 to 6000; and (3) a vinylidene compound selected from the group consisting of styrene, the methyl styrenes, the halo styrenes, vinyl naphthalene, acrylonitrile, methacrylonitrile, N-alkyl and N,N-dialkyl amides of acids selected from the group consisting of acrylic and methacrylic acids, the number of carbon atoms in each N-alkyl radical not exceeding twenty, alkyl esters of acids selected from the group consisting of acrylic and methacrylic acids, the number of carbon atoms in the alkyl group not exceeding twenty, vinyl pyridine, vinyl furane, vinyl cyclohexane, monovinyl ketones of not over twenty carbon atoms, and vinyl halides, said mixture containing one equivalent polyepoxide per carboxyl equivalent acid ester and from twenty to seventy percent monomer by weight based on the total composition, considering an equivalent polyepoxide as the weight of epoxide in grams per epoxide group and a carboxyl equivalent acid ester as the weight in grams of acid ester per carboxyl group.

Cellulose Ester Compositions

U. S. Patent 2,956,895. Martin Salo Gerard J. Clarke, Rochester, N. Y., assignors to Eastman Kodak Co., Rochester, N. Y., a Corp. of N. Y.

A coating composition adapted to be used for the production of water resistant coatings which essentially consists of an aqueous solution of cellulose acetate having an acetyl content of 12-19% containing 5-20% of dimethylol urea based on the weight of the cellulose acetate and a di alkyl acid phosphate catalyst.



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Coating Solution, Process for Preparing

U. S. Patent 2,963,388. Guy Landouar, Saint-Maur, France, assignor to Societe Anonyme dite: Anciens Etablissements Desmarquoy, Paris, France.

A solution of organic materials selected from the group consisting of synthetic rubber, natural rubber, polymerized acrylic monomers, polymerized vinyl monomers and polymerized ethylene monomers, in an organic solvent medium, said solution having a viscosity sufficient to permit it to spread without the addition of solids over the surface of a porous material and to form on said surface a smooth superficial coating free from cracks and swelling, said solution containing 1 to 35% by weight of water in proportion to the organic solvents, said solvents selected from the group consisting of chlorinated solvents, ketones, esters of lower alcohols, gasoline, toluene and cyclohexane, and the viscosity of said solution would be reduced by at least 20% by the elimination of said water, this reduction in viscosity increasing on an increase in the proportion by weight of water and with a decrease in the proportion by weight of dry material and the weight of solution.

A process for depositing a coating on a member made of an elastic cellular material, consisting in depositing a solution according to claim 1, on said cellular material to provide a coating thereon and submitting in situ said coating to a treatment selected from a group consisting of curing and polymerizing treatments.

Multicolor Coating Compositions

U. S. Patent 2,964,417. Alton J. Ward, Miami, Fla., assignor, by mesne assignments, to Airkem, Inc., New York, N. Y., a Corp. of N. Y.

The process for preparing two-phase anhydrous coating compositions that comprises preparing a carrier vehicle by dissolving a first film former, characterized as readily soluble in hydrocarbon solvent, in an organic solvent comprising a major proportion of hydrocarbon solvent, preparing a lacquer vehicle by dissolving a second film former, characterized as readily soluble in oxygenated lacquer solvent selected from the group consisting of ethers, ketones, alcohols and mixtures thereof and insoluble in hydrocarbon solvent, in an organic solvent comprising a mixture of oxygenated lacquer solvent selected from the group consisting of ethers, ketones, alcohols and mixtures thereof and an amount of hydrocarbon solvent which is insufficient to cause precipitation of said second film former, and adding said lacquer vehicle slowly to said carrier vehicle while agitating the same to thereby convert said lacquer vehicle to soft, pliable, discrete lacquer

particles of irregular fibrous to flake-like contour dispersed in said carrier vehicle.

Vinyl Chloride Polymer

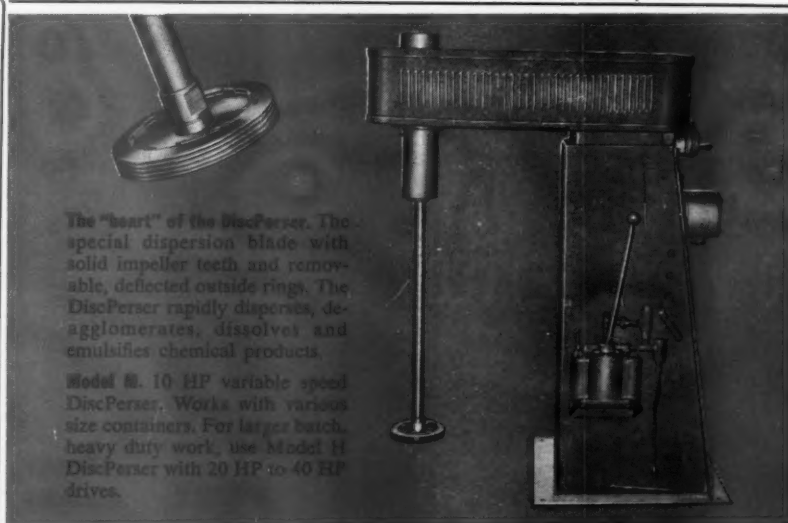
U. S. Patent 2,965,598. Gail H. Birum, Dayton, Ohio, and Tracy M. Patrick, Jr., Kirkwood, Mo., assignors to Monsanto Chemical Co., St. Louis, Mo., a Corp. of Dela.

A resinous composition of matter which comprises a polymer selected from the group consisting of polyvinyl chloride and copolymers of at least 70 percent of vinyl chloride and up to 30 percent of another monoethylenically unsaturated monomer, and a compound selected from the group consisting of butyl 9-carbobutoxystearate, butyl 10-carbobutoxystearate, and mixtures thereof.

Coating Composition

U. S. Patent 2,964,486. Napoleon M. Bernier, 99 Louise Road, Belmont, Mass.

A trowelable mastic composition for application to walls, comprising by weight 50% to 80% aggregates selected from the group consisting of vari-colored stone, marble, granite, colored glass, porcelain, and slag, said aggregates being 1/32 to 3/8 inch in diameter, 4% to 12% clear resin from the class consisting of methyl methacrylate polymer, butyl methacrylate polymer, isobutyl methacrylate polymer, ethyl methacrylate polymer, methyl acrylate polymer, ethyl acrylate polymer, and propyl acrylate polymer, 1/2% to 5% jelling agent from the class consisting of dimethyldioctadecyl ammonium bentonite, colloidal silica, aluminum octoate, aluminum stearate, and hydrogenated castor oil, and the remainder a volatile solvent for said resin from the group consisting of xylol, mineral spirits, toluol, benzol, and naphtha.



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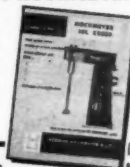
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Bulletins

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Aliphatic amines—what they are and what they will do—are described in a new booklet.

Trade named "Armeens," these organic bases derived from fatty acids are versatile surface active agents having wide commercial acceptance.

The booklet gives compositions as determined by gas chromato-

graphy and includes complete specifications, physical properties reactions and other data for primary, secondary and tertiary amines along with specialty and polyethoxylated amines.

Armeens retain most of the reactivity of ammonia, while the long, normal alkyl groups obtained from their parent fatty acids impart additional desirable properties.

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Armour Industrial Chemical Co., Dept. PVP, 110 N. Wacker Dr., Chicago 6, Ill.

RESINS

New brochure describes firm's complete line of polycarbonate resins, phenolic resins, varnishes and molding powders, and fused magnesium oxide.

Designated CDC-381, the illustrated 12-page catalog covers product features, applications, and detailed technical data on Lexan polycarbonate resins, phenolic molding powders. Also described are phenolic laminating varnishes, phenolic foundry resins, Methylon coating resins, phenolic industrial resins and varnishes, and electrically fused magnesium oxide.

The booklet (CDC-381) has been compiled as an aid to designers, molders, fabricators, formulators, and end-users.

Chemical Materials Dept., General Electric Co., Dept. PVP, One Plastics Ave., Pittsfield, Mass.

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The three-color bulletin describes by text and step-by-step illustrations the proper method of lubrication for all the types of lubricated plug valves, the correct adjustment of valves; how to repack valves with plastic stem packing, etc.

The bulletin also includes a chart of recommended lubricants and photos and description of firm's lubricant dispensing equipment.

Rockwell Manufacturing Co., Meter & Valve Div., Dept. PVP, 400 North Lexington Ave., Pittsburgh 8, Pa.

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LAKOKRASOCHNYE MATERIALY I IKH PRIMENENIE

Copolymerization of Alkyd Resins with Styrene in Presence of Peroxide Initiators.

N. N. Rozovskaya, P. M. Bogatyrev, N. M. Nesterova, and R. N. Alexina.

Lakokrasochnye Materialy i Ikh Primenenie, 1960, 4:3-6.

A study of the effect of various peroxides (benzoyl peroxide, isopropylbenzene hydroperoxide, phenylisopropylethyl peroxide, dicumyl peroxide, *tert*-butylperbenzoate, di-*tert*-butyldiper-

phthalate, and *tert*-butyl peroxide) and of oxygen as initiators on the copolymerization of alkyd resin with styrene. The presence of oxygen accelerates the copolymerization (at 140°C, with xylene as solvent) considerably, decreasing the molecular weight of the formed styrene polymers and copolymer. It appears that apart from thermal initiation, oxygen (or peroxides formed by the action of oxygen on unsaturated compounds in the reaction mixture) acts as initiator.

Insufficient amounts of oxygen may have to be supplemented by addition of a peroxide. *Tert*-butyl peroxide appears to be the most suitable initiator of the copolymerization reaction; it leads to practically full conversion of styrene, and it considerably shortens the production cycle of the alkyd-styrene synthesis. *Tert*-butyl peroxide also strongly increases the viscosity of the reaction mixture; to obtain stable, non-gelatinizing alkyd-styrene lacquers, low viscosity alkyds, prepared by the azeotropic method, should be used for the copolymerization. Peroxides having low decomposition temperatures (benzoyl peroxide, isopropylbenzene hydroperoxide) do not cause any viscosity increase of the reaction mixture; with these less stable peroxides, the usually employed alkyds may be taken for the synthesis.

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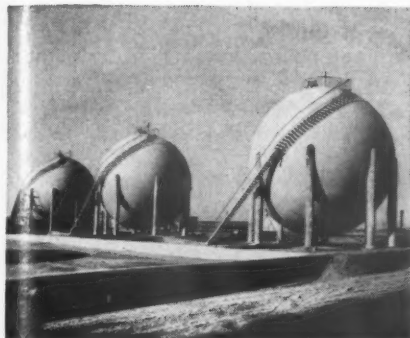
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Graft copolymers on Nitrocellulose Basis and their Film-forming Properties. Communication I.

Ya. L. Raskin, L. M. Livshits, and A. A. Berlin. *Lakokrasochnye Materialy i Ikh Primenenie*, 1960, 4:6-10.

The first of a series of papers reporting on studies in quality improvement of nitrocellulose coatings, in particular their stability to atmospheric exposure and to light, and their lower inflammability. Of the possible ways of attacking the problem, the preparation of graft copolymers based on peroxidized (by ozonization) nitrocellulose and acrylic polymers was considered most promising. The ozonization process was found to be accompanied by destruction of nitrocellulose manifested in lowering of viscosity, and in accumulation of carboxyl groups. The degree of nitrocellulose destruction increases with the length of the ozonization treatment, and with increasing degree of viscosity of the starting nitrocellulose. In graft polymerization of peroxidized nitrocellulose with butylacrylate (in aqueous and solvent media the composition of the graft polymer depends on the initial ratio of reactants; increasing the amount of butylacrylate results in higher butylacrylate content in the product. The amount of homopolymer depends on the reaction mixture: it is higher when the polymerization is carried out in a solvent medium. In studying the thermomechanical properties of the grafted copolymers, the authors established that the copolymer transition temperature does not depend on its composition. Based on these graft copolymers, a number of coatings was prepared which equal those based on nitrocellulose alone as regards impact resistance, adhesion, elasticity, water stability, and luster retention, and which surpass them as regards stability to light.

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Investigation of Spectral Reflectance of White Oil Paints.

L. V. Micai. *Lakokrasochnye Materialy i Ikh Primenenie*, 1960, No. 3, 55-57.

The spectral reflectance curve of a coating, drawn from determined values of monochromatic light bands (400-760 mμ) reflected from a paint film, best characterizes the color and intensity of a pigment as well as the condition of the paint surface. The paper reports on a study of the reflectance capacities of white oil paints pigmented with varying amounts (30, 50, 70%) of white pigments (lithopone, zinc oxide, titanium dioxide), in the near UV and visible regions. In the visible region, the pigments possess a very weak absorption; in the UV region, a sufficiently high selective absorption. In each case, the absorption is specific for a given pigment. Oil paints whose pig-

ments have a high refractive index possess high spectral reflectance in the visible region. With decreasing pigment concentrations, the reflectance value decreases more rapidly for films whose pigments have a low refractive index. Increased pigment concentration leads to higher reflectances in both UV and visible regions; in the visible region, however, an increase in pigment concentration beyond a certain limit increases the spectral reflectance in the blue visible region, and decreases it somewhat in the long-wave region. The determinations were carried out on the quartz prism photoelectric spectrophotometer SF-4.

Phosphatizing Primer VL-08.

K. P. Belyaeva, A. M. Grozovskaya, I. M. Alekseev, S. M. Pichugin. *Lakokrasochnye Materialy i Ikh Primenenie*, 1960, No. 3, 23-25.

Having established that phosphatizing primers from aq. zinc chromate pastes are superior to primers based on dry, coarsely dispersed pastes, the authors prepared the phosphatizing primer VL-08 consisting of the following components (in weight %): polyvinyl butyral 9.7, Zn chromate 9.3, butyl alcohol 20.25, ethyl alcohol 60.75. The corrosive stability of the primer depends on the degree of Zn chromate dispersion, on the ratio of H_3PO_4 to CrO_3 , and on the thickness of the applied coat. Highest anti-corrosive properties of the primer were found to be at a 2:1 proportion of H_3PO_4 to CrO_3 , and at coat thickness of 6-12μ. The primer, which considerably increases the anti-corrosive stability of protective coatings and is claimed to be superior in this respect to WP-1 primer, is recommended for preliminary surface application on ferrous metals.

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- HYDROUS AND ANHYDROUS ALUMINUM SILICATE PIGMENTS
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Synthesis of Resins Based on *p*-tert-Butyl Phenol in Presence of Surface-Active Substances.

Lakokrasochnye Materialy i Ikh Primenenie, 1960, No. 3, 2-8.

The reaction between *p*-tert-butyl phenol (BP) and formaldehyde (F), catalyzed by an acidic catalyst (HC1) and carried out in aq. medium, proceeds in the presence of an anionic surfactant; neither cationic nor non-ionic surface-active agents have any effect on this reaction. The anionic surfactant used by the author was a sodium salt of isobutyl naphthalene sulfoacid (wetting agent "NB"). The mode of action of "NB" is not that of a catalyst; the mechanism of its action is not known. Reaction rate depends on "NB" concentration: the former increases parabolically with increasing concentration of the wetting agent. The hydrogen concentration of reaction medium also effect the rate: reaction rate increases linearly with decreasing pH; no reaction takes place at pH lower than 2.2. In the absence of the anionic surfactant, the reaction between (BP) and (F) in acid medium proceeds at an insignificant rate only. The author reports on his investigation of the basic kinetic relationships of the reaction. The prepared resin is similar to the final product obtained by using alkaline catalysts (m.p. 70-90°C; mol. weight 500-1,000; solubility in all organic solvents, etc.). The described condensation reaction may be applicable to other reactions of similar type.

A Study of Coatings from Cresol-Formaldehyde Resin and Polyvinylbutyral.

S. V. Yakubovich and M. I. Karyakina. *Lakokrasochnye Materialy i Ikh Primenenie* 1960 4:20-26.

The paper describes the investigation

of the properties of said coatings and the determination of the relationship of mechanical properties of films to their protective characteristics. Mechanical properties were studied in the 20-150°C. interval. In studying the internal stresses occurring in these coatings during the film-forming process the authors found that polyvinylbutyral plays the role of plasticizer; a decrease in its viscosity leads to considerable diminishing of internal stresses in the film. It is suggested that the remainder of the high-boiling solvent (cyclohexanone) also acts as plasticizer in the lacquer. Hardness measurements in the indicated temperature range permit to tell the transition of the film-forming substance from one physical state into another. Coatings with high physico-mechanical and anti-corrosion properties were prepared from this lacquer containing cresol-formaldehyde resin and low-viscosity polyvinylbutyral (using ethyl alcohol and cyclohexanone and 3% solution of NaCl as solvents); their stability to water increases with the decreasing molecular weight of polyvinylbutyral.

The Effect of Pigments on Photochemical Destruction of Cellulose Nitrates in Paint and Varnish Coatings.

A. I. Plyplina, Z. A. Rogovin. *Lakrasochnye Materialy i Ikh Primenenie*, 1960, No. 3, 36-38.

A study of the effect of chemical composition and quantity of pigments on the properties of nitrocellulose lacquer films. The tabulated data show that addition of pigments to nitrocellulose coatings considerably decreases the photochemical destruction of cellulose nitrate (CN); large amounts of added pigment prevent both the photochemical destruction (even after prolonged irradiation) and partial denitration of (CN) in the film. In this effect, both the type of pigment and its color play a role in pigment amounts larger than 2%. Carbon black was found to have the strongest protective effect, aluminum powder the smallest; in equal quantities, organic pigments show better results than inorganic pigments (exception: carbon black). The protective property of carbon black does not appear to be specific for (CN) films only. The protective action of added pigment increases with increasing pigment amounts but only to a definite limit. The optimum amount of pigment depends on its chemical composition. Addition of smaller amounts of some pigments also decreases the photochemical destruction of (CN), however (for example, carbon black in amounts of 2-5% of (CN) weight). The effect of the amount and type of added pigment on the lowering of the (CN) degree of esterification is insignificant,

particularly at small amounts of carbon black. Certain Ti pigments, which have a destructive action on oil-containing, film-forming substances, do not exhibit photochemical activity in the two-component systems (CN)-pigment. The paper tabulates the effect of various quantities (0-100%) of TiO₂, Zn whites, carbon black, red oxide, Al powder and Milori blue on the intensity of photochemical destruction of (CN).

Rheological Properties of Solutions of the Copolymer of Butyl Methacrylate and Methacrylic Acid.

P. I. Zubov, N. F. Proshlyakova. *Lakrasochnye Materialy i Ikh Primenenie*, 1960, No. 3, 8-13.

It is shown that concentrated solutions of the copolymer (spec. weight 0.937 g/cm³) of butyl methacrylate and methacrylic acid (6.7 : 93.7 mol.

%) in cyclohexanone in the presence of NaOH are gel-forming. The authors studied the effect of pigments (TiO₂, TiO₂ + 3% ZnO, and ZnO) on the structural-mechanical properties of the polymer in solution. In presence of ZnO, concentrated solutions of the copolymer in cyclohexanone have steric configuration, apparently as a result of a reaction between methacrylic acid and zinc oxide. Addition of either TiO₂ or TiO₂ + 3% ZnO does not lead to steric configuration in the copolymer solution; the former pigment (TiO₂) slightly increases the viscosity of concentrated solutions of the copolymer. The formation of steric structure in concentrated solutions of the copolymer in presence of NaOH indicates that such a process may also take place in the presence of other metals.



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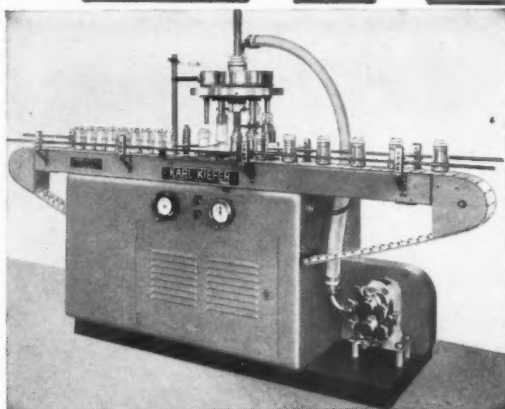
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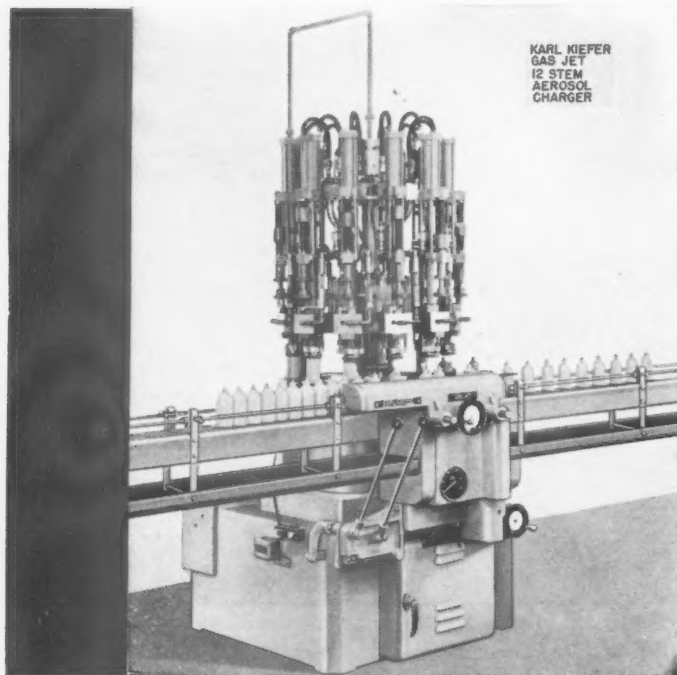
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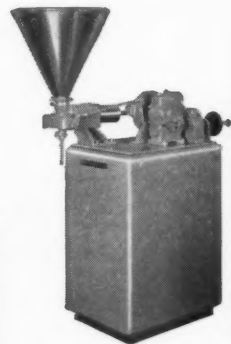
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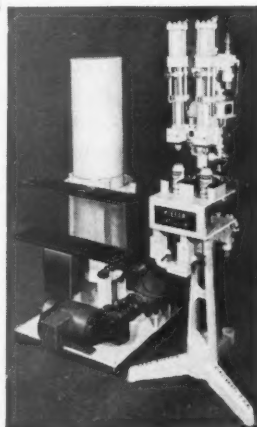
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AEROSOL COATINGS

PACKAGING

FORMULATION

PRODUCTION

The aerosol laboratory plays an important part in the growth of aerosol paints. To maintain this growth new products must be formulated and older ones improved. This can only be accomplished through a well-equipped laboratory. How to set-up an aerosol laboratory is the subject of this month's aerosol feature. Space requirements and equipment necessary to perform adequate research and testing of aerosol paints are presented in this article. See page 89.





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HOW TO SET UP AN AEROSOL LABORATORY

By
Dr. John J. Sciarra*

DURING the past fifteen years, the aerosol industry has grown to a tremendous size and continues to expand at a rapid rate. This constant growth has been attributed to the large number of products in aerosol form. That these products have been fully accepted by the vast majority of the American public is evidenced by the fact that during 1959 over 500 million aerosol units were produced representing a market of about $\frac{3}{4}$ of a billion dollars. Paints and other type coatings and finishes accounted for about fifty two million units which becomes even more impressive when one considers that in 1958, about 30 million such units were produced.

In order to keep up this growth, new products must be formulated and the older ones must constantly be improved. This can only be done in an aerosol laboratory. Many of the contract loaders maintain research laboratories, and these laboratories together with the development research laboratories of the various manufacturers of propellants, valves, containers, and other raw materials have accounted for a large number of the existing aerosol products. Aerosol products are born in a research laboratory,

and may well represent the future growth of the aerosol industry.

There are several advantages to the establishment of an aerosol research laboratory of your own:

1. Complete supervision of the research and development program is maintained at all times.
2. No time is lost in sending samples back and forth between your plant and the laboratory of the contract loader or supplier of component parts of the aerosol.
3. Lack of time on the part of the outside laboratory will not delay the completion of your product. Since these laboratories must of necessity serve many customers they must give preference to certain products from time to time.
4. By closely working with the laboratory personnel knowledge is gained which may lead to improvements in existing products or ideas for new products.
5. If your plant does its own filling of aerosol products, then the laboratory will be of greater value in working out production problems as well as other problems which may arise from time to time.

6. Maximum benefit can be derived from an aerosol research program when the laboratory is closely associated with the parent plant.

7. The aerosol laboratory can serve as the control laboratory for aerosol products regardless of whether they are produced in your plant or by a contract loader.

All too often plans for setting up an aerosol research laboratory are postponed due to lack of space and expenses. However, when one stops to consider this in more detail, it is found that not much space is required and the expenses are considerably less than one might expect.

Space Requirements

A portion of an existing laboratory may be well suited for setting up the aerosol laboratory. One might be able to accommodate the necessary equipment on a laboratory table of about 2' x 15'. This will be sufficient to get started and can be expanded as the need arises. However, it may be wise to give some thought to having a separate laboratory for this purpose. An unused storeroom can be easily converted into a useful laboratory. A portion of the space in the plant can be partitioned to make a separate laboratory.

At St. John's University, a medium sized laboratory is devoted exclusively to aerosol research. While this laboratory would be more than adequate for most Concerns it might be worthwhile to point out some of its features as an aid to those contemplating establishing such a laboratory.

The laboratory is about 12' x 21' and has work tables along both sides of the wall. One wall is lined with cabinets which can be used to store raw materials while the other wall contains propellant racks and additional shelves. One sink is present with both hot and cold water. A source of electricity gas (this may not be needed) air, and vacuum are also present. Storage space such as drawers, cabinets, etc., one needed to store a supply of aerosol valves, containers, and other component parts for the aerosols. Figure 1 shows such a

*Associate Professor of Pharmaceutical Chemistry, St. John's University, College of Pharmacy, Jamaica 32, New York.



Fig. 1. Storage for aerosol components

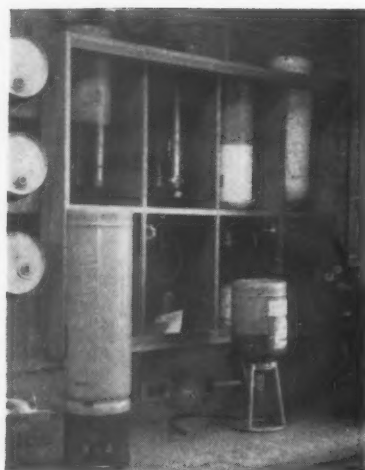


Fig. 2. Propellant cabinet.



Fig. 3. Propellant storage racks.

cabinet. When planning a laboratory, space should be provided for maintaining the cylinders of propellant so that they can be safely used and will not take up too much room. Propellant cabinets for holding four-cylinders of propellants each containing about twenty-five pounds of propellant are shown in Figure 2. When necessary they can also be supported by means of small stands made specially for this purpose. This seems to take care of the propellant needs of a small sized laboratory. If larger sized cylinders of propellant are needed special stands can be made as shown in Figure 3. These stands were made in our machine shop and are capable of holding two 150 pound cylinders of propellant. The propellant is then transferred to smaller cylinders as needed.

Specialized Aerosol Equipment

In order to handle liquefied gases

in the laboratory and then able to prepare an aerosol package several pieces of equipment are necessary. Through choice of proper equipment one is able to fill and prepare all types of aerosol products without much difficulty and a minimum cost.

Pressure Filling Apparatus

This consists of a pressure burette capable of metering small volumes of liquefied gas under pressure into an aerosol container. This is carried out at room temperature and can be successfully used for those products containing large amounts of water or are destroyed by low temperature. The propellant is added through the inlet valve generally located at the bottom of the burette. Trapped air is allowed to escape through the upper valve. Then the desired amount of propellant is allowed to flow through the aerosol valve into the container under its own vapor

pressure. When the pressure is equalized (which happens especially with low vapor pressure propellants) between the burette and the container the propellant stops flowing. To aid in adding additional propellant, a hose leading to a cylinder of nitrogen can be attached to the upper valve and the added nitrogen pressure will cause the propellant to flow. Another pressure filling device makes use of a piston arrangement so that a positive pressure is always maintained. Figures 4 and 5 show typical pressure filling equipment.

Cold Filling Apparatus

This apparatus is somewhat simpler than the pressure filling apparatus. All that is needed is an insulated box filled with copper tubing which has been coiled in order to increase the area exposed to cooling. The end is fitted with a Hoke valve or similar fittings. Prior

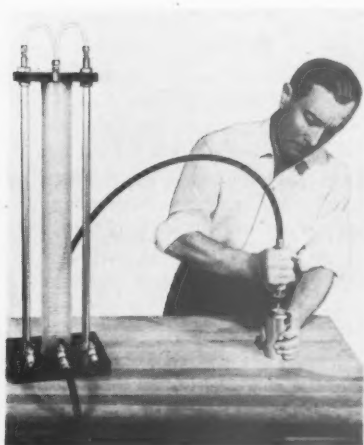


Fig. 4. Burette pressure filler.



Fig. 5. Piston type filler.

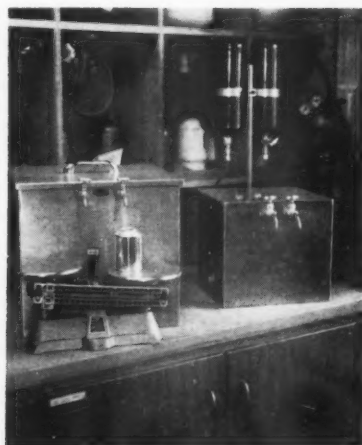


Fig. 6. Cold filler

to use, a mixture of dry ice and acetone is added as the chilling media. This produces temperatures in the range of -40° and is low enough to liquefy most propellants. More elaborate units are commercially available for this purpose. Figure 6 illustrates this equipment. Where the cold filling process is used to a considerable extent, a deep freeze cabinet (capable of temperatures of about -40°) can be fitted with copper tubing and serve as the cold filling unit. In addition this can also be used to evaluate the product at low temperature. This method of filling is generally faster than the pressure filling method since the propellant is added before the valve is crimped in place rather than through the small opening located in the aerosol valve. For those cases when low temperature will not affect the product it is the preferred method.

Can and Bottle Capper

Since aerosols are packaged in both metallic and glass containers, two cappers are needed. However, with paint and related products the



Fig. 7 Can and bottle crimper.

metal container is used to a great extent and a capper for this container may be all that is necessary. A combination can and bottle capper, set up to crimp valves on a metallic container is shown in Figure 7. This can handle most laboratory procedures. Can cappers operating on air pressure (about 80 pounds per square inch) or

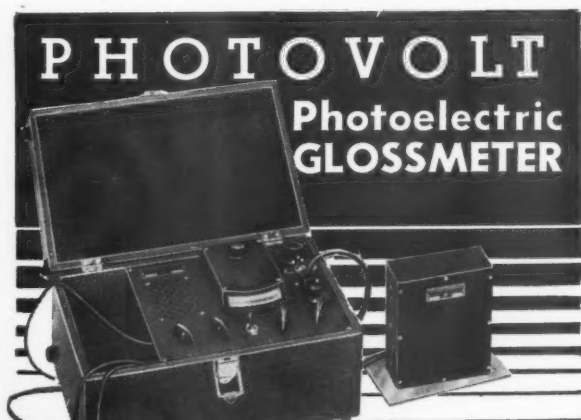
vacuum are also available. These generally are capable of producing about 10-12 cans per minute.

Water Bath

This bath is held at approximately 130°F and is used to test each container for leaks as well as to test the strength of the container. Every product should be tested at this temperature before it is placed under other tests. A leaking valve can be a source of error in results obtained under storage. The only exception to this would be those products which are decomposed at 130°F . These should be tested at whatever temperatures necessary.

Oven

This oven is used to test the product in order to determine the shelf life. The best temperatures to carry out these studies have never been definitely established although suggested temperatures of 98°F and 130°F are used to some extent. Corrosion is accelerated with an increase in temperature and therefore evidence of corrosion can be noted before it will actually take place on the dealers shelves.



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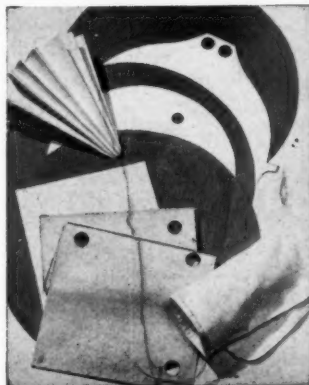
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Aerosol Developments

New Brochure is Guidebook To Aerosol Packaging

"Every manufacturer today should make himself familiar with the possibilities of the self-spraying aerosol container—either as a package for his product or as a touch-up finish, a cleaner, a lubricant or some other accessory to be distributed in

connection with his product," says John G. Ellis, President of Sprayon Products, Inc., Cleveland, Ohio in a foreword to a new aerosol "guidebook" published by Sprayon.

Points to be considered in evaluating a new product for aerosol use are discussed in the new brochure. The various filling processes are

outlined, with step-by-step photographs taken on the actual filling lines.

In addition, a new kind of sprayer is described which solves the old aerosol problems of too-small quantities and unstable or incompatible products.

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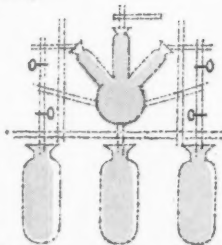
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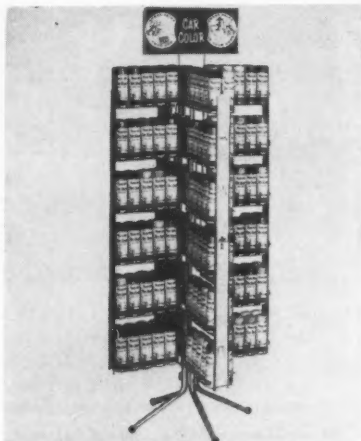
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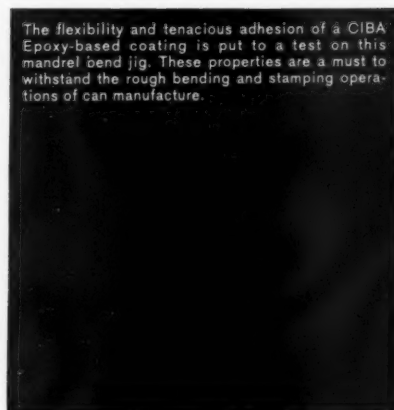
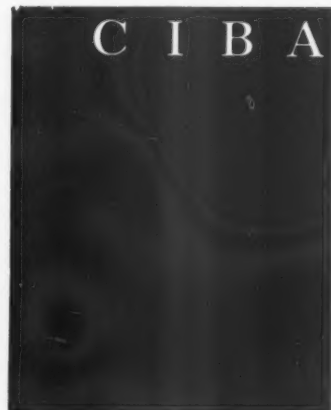
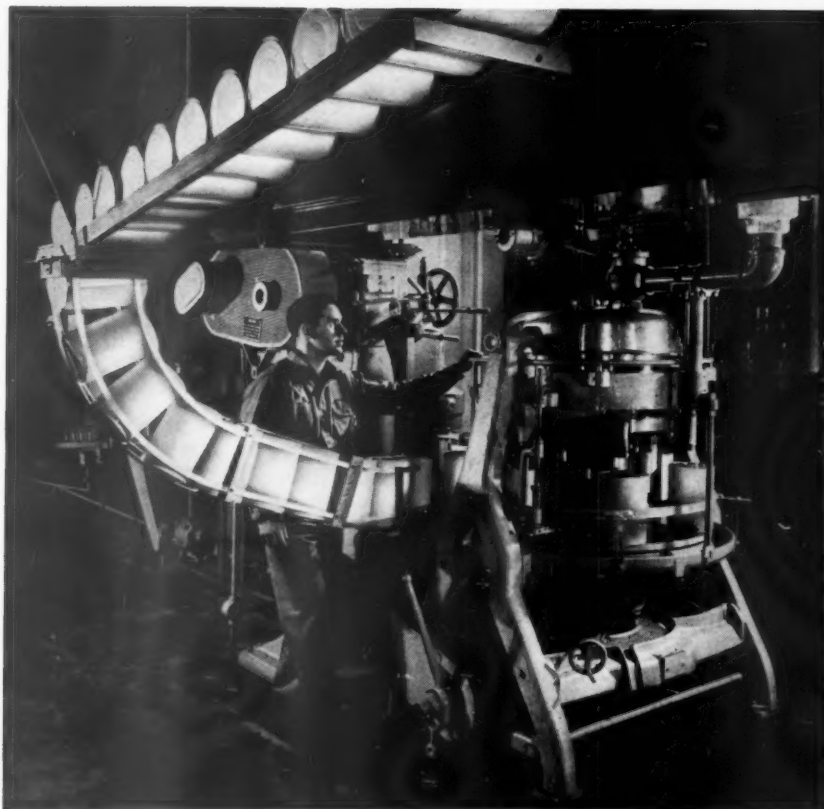
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TRENDS IN ALKYDS

(From page 51)

Continual expansion of raw material horizons is also important. Again, results of the past few years which demonstrate themselves in new polyols, a variety of new anhydrides and dibasic acids, and highly refined fatty acids indicate the awareness of the industry to this problem.

Formulation of alkyds more attractive to "the do-it-yourself" trade such as products with low odor solvents and thixotropic materials, in which the pigment does not settle and which tend to be dripless, also provide an important area of research. Aerosol packaging also offers an approach to expanding "do-it-yourself" sales.

Improvement of properties, particularly corrosion resistance and solvent resistance, will certainly provide greater vistas for alkyd resins.

Alkyd Combinations

Although a great deal of work has been done on combination of alkyds with other materials, there is still more to be done, particularly as other new resins become available. Indeed, one of the important virtues of the alkyds lies in their compatibility with other resins and film formers which makes it possible to modify alkyds for highly specific purposes. The com-

bination of alkyds with urethanes, silicones, fluorinated polymers, titanium esters, vinyl dispersions, and other materials too numerous to mention offer expanding horizons for the improvement, not only of corrosion and solvent resistance, but for building properties such as higher temperature resistance and faster drying properties into the coatings.

Alkyd resin usage will be increased by research on pigments which help to improve the gloss and weathering properties of the vehicle and by research on application methods which will contribute to film properties and application ease.

Mention has been made several times above of the possibility of formulating water dispersed or water soluble resins based on alkyds. Certainly much can be expected here in the future.

Another area for the alkyd technologist to consider, following an important trend in the protective coatings' industry, is that of solventless coatings.

Solventless Coatings

One of the important objectives of the paint industry in the past decade has been to achieve coatings which may be applied readily to provide good films but which still do not require solvent.

The solvent in most coatings is merely a means for facilitating application and for making sure that continuous films result. If compositions of sufficiently low viscosity can be achieved which do not require solvent, then extensive economy will have been achieved with added plus features of safety and freedom from solvent odors. The possibility of combining isocyanates with alkyd resins in solvent free combinations has been explored and is one possible route to achieving freedom from solvent.

Considerable success has been achieved in this area with polyesters which, of course, are very close relatives of the modified alkyd resins. With polyesters, styrene is used as a diluent and in the curing process the styrene is incorporated as a copolymerizing agent. It is entirely conceivable, of course, that this same type of technology can be applied to oil modified alkyd resins.

Another approach to solvent free coatings is via the fluidized bed technique. This requires a solid powder which can be micronized so that it will behave like a fluid when subjected to a mild positive air or gas pressure. The heated metal object to be coated is then inserted in this "fluid". Post curing way, of course, be necessary in order to achieve flow of the solid particles and optimum film properties. Thus far, a great deal of headway does not appear to have been made in adapting alkyds to this technique.

Finally, of course, continual work on alkyd theory and research aimed at an understanding of functionality as related to alkyd resins is important. The key to the future of alkyd resins is, of course, research. Although we have stressed applied research in the above discussion, certainly too much emphasis cannot be placed on the fundamental research which will provide the basis for the truly great innovations.

Typical of an important area of basic research is work on molecular weight distribution which should make possible the manufacture of more uniform products.

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COMMERCIAL CAN CORPORATION, Newark, N. J.
STANDARD CAN CORP., Leesdale, Pa.

PERSONNEL CHANGES

NATIONAL ANILINE

Max Saltzman has been named Technical Assistant to the Vice President.

In his new position, Mr. Saltzman will be responsible for the coordination of research and development projects in connection with pigments and pigment intermediates. Long associated with the color industry, Mr. Saltzman for the past five years has been Manager of Special Projects in charge of the Spectrophotometer and Analytical Laboratories of Harmon Colors.



Max
Saltzman



R. H.
Cannon

EASTMAN

Robert H. Cannon, Jr., has been named to the newly created post of Assistant Sales Manager in Charge of Field Sales. Mr. Cannon has most recently been eastern regional sales manager with headquarters in the company's distribution center at Lodi, N. J.

George J. Taylor, formerly District Sales Manager in Charge of the division's Philadelphia office, has become Eastern Regional Sales Manager.

W. C. Cooke has become District Sales Manager of the Philadelphia office.

R. Clay Dubberly, formerly Sales Representative in charge, has been named District Sales Manager of the division's Cleveland office. Also, **David S. Oaks**, a new Sales Representative, has been assigned to this office.

SHERWIN-WILLIAMS

Arthur W. Steudel, President of the firm since 1940, was elected Chairman of the Board and Chief Executive Officer.

Named to succeed Mr. Steudel as president was **E. Colin Baldwin** who for the past year has been Vice President and General Manager.

CARBOLA CHEMICAL

Norman J. Bonner has been appointed Technical Director for the company.

PITTSBURGH PLATE

David M. Keck has been named Technical Director for the Houston, Texas, paint factory of the paint and brush division.

He succeeds **Otto J. Hartwick** who has retired after completing 32 years of service with the company.



D. M.
Keck



J. A.
Fertig

NATIONAL STARCH

Dr. Joseph A. Fertig has been promoted to the position of Supervisor in the Resin Research Group at the Alexander Research and Development Laboratories.

HEYDEN NEWPORT

S. J. Spitz, Jr. has been appointed President of the Newport Industries Division. Mr. Spitz is succeeding E. F. Sisson, who resigned January 1, after 32 years with the firm.

GENERAL ANILINE

The appointment of three administrative executives has been announced.

These executives will direct the activities in the major areas of the Research and Commercial Development Department.

Dr. Charles F. Jelinek was appointed Manager of the Group's Central Research Laboratory at Easton, Pa., where he will be responsible for new fields research programs and technical service activities carried on at that location.

Dr. Cecil M. Knowles has been appointed Manager of Commercial Development, responsible for market research, market development and related business services.

Thomas D. Mutaftis has been appointed Manager of Research Engineering and will direct engineering research.

LAMBERT CORP.

C. R. Rowilson has been appointed Sales Manager.

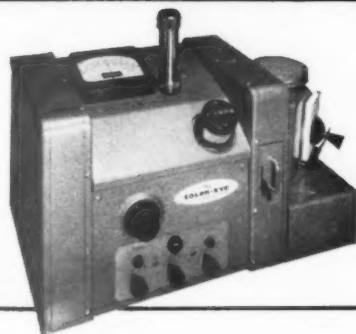
Mr. Rowilson is a Chemical Engineer Paint Chemist, and has been connected with the paint, varnish and lacquer industry for over 20 years.

CIBA

Edward T. McBride has joined the firm as a Technical Sales Representative in the company's pigments division.

Color Control

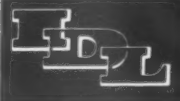
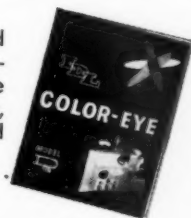
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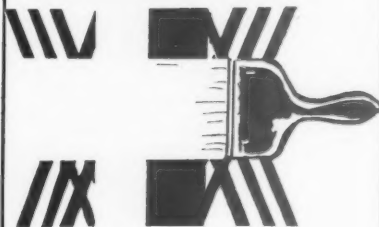
DEWEY AND ALMY

Fred P. Tarr became a Development Engineer in the Process Development Department of the Organic Chemicals Division.

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Micro Mica C-1000
Micro Mica C-3000

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Chemist experienced in lacquers and architectural paints. Write to Mr. Arthur M. Golden, Flood & Conklin Mfg. Co., 136 Chestnut St., Newark 5, N. J.

NATIONAL LEAD

Jack J. Smith has been appointed Sales Manager, Industrial Products, for the Pacific Coast branch. Mr. Smith will direct the marketing or maintenance finishes, product finishes and other custom-formulated products to the industrial trade throughout the 11 western states as well as Hawaii and Alaska.

GENERAL ANILINE

General Dyestuff Co., announces the following executive changes.

Dr. John C. Lawler has been named Director of Manufacturing.

Dr. Stiles M. Roberts has been appointed Technical Director of the Division.

H. Alison Webb has been named Director of Marketing.

VULCAN CONTAINERS

Howard F. Krickl, has been named to head technical sales-service at Bellwood, Ill.



H. F.
Krickl



J. F.
Kilcullen

NUODEX PRODUCTS

John F. Kilcullen has been named Vice President of Manufacturing and Dave Bush, Controller.

GLIDDEN

Dr. Harry J. Kiefer has been appointed Director of Research for the paint division.



H. J.
Kiefer



R. J.
Lindquist

MINNESOTA LINSEED

Ray J. Lindquist Jr. has been elected President. The Board of Directors also named J. D. O'Keefe Vice President and Treasurer, and E. H. Russell Vice Chairman of the Board.

WATSON-STANDARD

Robert J. Hardy has been named as Group Leader in charge of the Metal Litho and Industrial Finishes Labs.

COMMERCIAL SOLVENTS

Winton J. Fowler has been named the firm's Southeastern Sales Representative.



W. J.
Fowler



C. M.
Wescott

FOY PAINT

Charles M. Wescott has been elected Vice-President-Marketing, and a Director.

UBS CHEMICAL

Salvatore Sanfilippo, has joined the laboratory staff. Mr. Sanfilippo, who has an extensive background in paint technology, will be engaged in furthering the development of gloss latex paints based on polymers for architectural and industrial trade sales. His association represents another forward step in the recent expansion of the company's paint application group.

REARDON

Victors R. Furst, has been appointed Divisional Sales Manager, Western Division. Mr. Furst, formerly Manager-Paint Jobbing Sales for W. P. Fuller & Co., with management experience in marketing, sales, purchasing and manufacturing in the industry, will headquarter in the San Francisco area.

MINNESOTA PAINTS

Clarence A. Hedlung has been named to the post of Northwest District Manager.

CELLOFILM

William J. Flynn has been named to the position of Vice-President in charge of Production. Mr. Flynn has been with the firm manufacturers of nitrocellulose solutions, for 31 years. Prior to his promotion he was plant superintendent.

At the same time, it was announced that Alan B. Coopersmith, formerly with New York Wood Finishing Supply Co., has been appointed Technical Director.

HEYDEN NEWPORT

E. C. Slaght, Jr. has been appointed Vice President and Technical Director of Newport Industries Division.

With offices in Pensacola, Florida, location of the Division's headquarters and largest plant, Mr. Slaght will organize and coordinate expansion and new product programs.



New Trends in Paint Buying Seen by W. P. Fuller's Brawner

THE next few years should see the strong development of a new trend in paint buying with the emphasis on quality rather than price, according to W. P. Fuller Brawner, President of W. P. Fuller & Co., oldest and largest paint and glass firm in the western United States.

"The massive tract building programs in this area naturally increased the amount of painting," said Mr. Brawner. "Thousands of returned veterans and re-settled defense workers filling such tracts made their first contact with paint as 'do-it-yourself' homedecorators.

"Unfortunately the tendency often was to buy cheaper grades of paint under the mistaken impression that this would save them money.

"This was a whole new class of home-owners, generally unaware of the possible damage inferior paint could do or how difficult and expensive it is to remove the remains of such paint and what a risk is involved in painting over it.

"They learned the hard way," he pointed out.

"But," he added, "they are learning. And the paint industry, realizing this, is encouraging the trend by attempting to educate consumers to buy quality instead of price. But it is important to the future that such a program of education be continuous and that

everyone in the industry joins the effort," he said.

Mr. Brawner pointed out that 25 years ago the paint manufacturers used as a general slogan "save the surface and you save all." This, he said, is still good advice, but it was lost sight of for a time in the search for beauty and special decorating effects.

This was the result of a remarkable surge after World War II in the demand for a wide range of colors to satisfy the color appetite of the public. People quickly learned that in addition to protection of surfaces, quality paints provided the cheapest means for redecoration and styling. Color by application of paint, also became a strong factor in industrial efficiency by providing a pleasant atmosphere in which to work, reducing eye strain and promoting safety.

"Although the do-it-yourself trend in America is bound to con-

tinue," said Mr. Brawner, "we believe there is a permanent place for the professional painter and as interest is stimulated in painting of any kind this is bound to increase the volume of work for the professional painter.

"In almost all cases, paint plays an important part and its importance is increasing in the electronics, aircraft and auto industries and in missile production. But of equal importance is the fact that we are experiencing a population explosion. The war babies are growing up and during the present decade will become new home-owners and paint consumers. They have been brought up in an age of scientific marvels—the age of electronics, the missile, the jet and the rocket. They have become used to excellence in performance and will be more demanding than their parents. They will look for quality in all things, including paint, and it is up to the paint industry to see that they continue to get it," he said.

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NEWS

NEWS OF COMPANIES, ASSOCIATIONS
TECHNICAL GROUPS
ITEMS OF GENERAL INTEREST



Marvin Hastings, (r), the winner of two sales awards in 1960, was honored at ceremony celebrating his 15th year with Luminall Paints, division of National Chemical & Mfg. Co., Chicago. Mr. Hastings, who is northern Illinois District Sales Manager for Luminall, was presented an inscribed gold wristwatch by National Chemical's President, Frank Roman.



Jack Adams, instructor of Binks Mfg. Co.'s spray painting school, shows students the correct way to hold a spray gun. School is operated by Binks for the benefit of all industry, is tuition-free. Dates for the winter and spring sessions are: February 6-10, March 6-10, April 3-7, May 1-5, June 5-9.

New Depts. at American Can

Research and Development Dept., Canco Div., American Can Co., announced the establishment of four new divisions:

The Research Division will be located in Barrington, Ill.

The Technical Service Division will be located in Maywood, Ill.

The New Products Division will continue to be located in New York City and

The Machinery Development Division will be located in Barrington, Ill.

FTC to Investigate Monopolistic Practices Charge

Suspensions of blacklisting, coercion, and other monopolistic practices leveled by giant paint companies through New York and Washington press centers against small businessmen in the 3 billion dollar U. S. paint industry have caused Rep. William C. Cramer (R.-Fla.) to ask Federal Trade Commission Chairman Earl Kintner for an immediate investigation of the facts.

Rep. Cramer asked that Mr. Kintner investigate the effectiveness of Federal anti-trust legislation against such discriminatory practices and said if present law did not protect innocent firms from such monopolistic activities, he is considering corrective legislation in the House when the new Congress convenes in January.

A complaint filed with the FTC recently by Mary Carter Paint Factories, Inc. alleges a smear campaign by the National Paint, Varnish, and Lacquer Assn., aimed at eliminating small independent companies which have been making inroads into the giants' market by original merchandising and marketing techniques, Rep. Cramer said.

Florida's only Republican congressman explained that, according to allegations, the NPVLA through its New York and Washington press representatives financed by a sizable war chest, has prejudiced the National and local Better Business Bureaus with misleading propaganda. The Better Business Bureaus have, in turn, caused newspapers, radio and television to exclude advertising of the independent manufacturers in a number of cities, he said.

Several of the independent manufacturers, he said, have run advertisements offering "two gallons for the price of one" for ten years, with no incidence of customer complaint. Only since the institution of the NPVLA's self-styled "crash" propaganda campaign have media begun to refuse this advertising.

"As a member of the Judiciary Committee of the House which deals with anti-trust and unfair competition, I am vitally interested in the complaint recently

NEWS

filed with the FTC by the Mary Carter Paint Factories, Inc., against the NPVLA's actions," Rep. Cramer said.

"The NPVLA has condemned all small paint firms which offer a free can of paint for each one sold, and has classified them all as guilty of misleading the public and making a low quality product. This indiscriminate accusation does not take into account the fact that the major 'two for one' manufacturer, Mary Carter, produces paint products impartially proven 'equal to or better than any on the market.'

He said the blacklisting scandal had come to his attention through the Carter company, a Florida firm of which Lowell Thomas is a director and Edward R. Murrow and New York's former Governor, Thomas E. Dewey are principal

stockholders. It has increased its annual sales from \$300,000 to \$17,000,000 in the past ten years. The firm, he says, has factories in Tampa, Florida; Matawan, New Jersey; Conroe, Texas; and Los Angeles, California, and is able to offer free paint to its customers through 500 retail outlets in 29 states by means of manufacturing and distribution economies and volume repeat sales based on quality.

"I am advised that no one has ever successfully challenged the quality of Mary Carter paints," the congressman said, "and certainly every private enterprise, in such promotions, should be free from coercive blacklisting resulting from the efforts of competitors."

In view of what he called unfair and oppressive action by the NPVLA, Rep. Cramer asked Mr. Kintner to advise him whether "Anti-trust laws or other Federal statutes offer protection on a competitive enterprise basis of small businesses like Mary Carter Paint Factories, Inc. against possible monopoly and unfair practices on

the part of a trade association acting in the name of the competitors of such small business."

Paint Companies Win Safety Awards

At a special dinner given by the New York Insurance Fund for Safety Award Winners, Charles H. Levine of Consolidated Chemical & Paint Mfg. Co., Inc. and John J. Wagner of Keystone Paint & Varnish Co. accepted Safety Awards on behalf of their respective companies, in recognition of their outstanding safety records for the period of July 1959 to July 1960.

McCloskey Varnish Company Expands Philadelphia Plant

McCloskey Varnish Co. announces the award of contract to Wintz Bros., Inc., for the construction of a 15,000 square foot, single level office and warehouse addition to the company's present plant at 7600 State Road, Phila.

This new addition will greatly aid the manufacturing operations in Philadelphia. Increased storage area will permit better service and faster deliveries to the firm's customers.

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Gentlemen:

The American paint industry undoubtedly produces today the finest coatings in history. The improvements in paint technology now offer paints that are longer lasting, faster drying, easier to apply and more decorative.

But these advantages are claimed by all paint manufacturers. To the customer, the only choice is, "Which brand is the least expensive?" Consequently, the only sales factor left is "price."

Now, with DIANOL PAINT INSECTICIDE incorporated in your paint, a new PLUS has been added. You can offer paint with all normal quality characteristics PLUS insect-killing action for years!

Insects are an annoyance and a problem from Maine to California, from Florida to Alaska. But now they can be eliminated by this improvement in coating technology—the additive DIANOL PAINT INSECTICIDE.

If we can be of service or if you desire any further information, please write us.

Sincerely,

Robert D. Spiers

ROBERT D. SPIERS
General Manager



NEWS

NYU Offers Course

The New York Paint and Varnish Production Club and The New York Paint, Varnish and Lacquer Association are offering a course, *Fundamentals of Paint, Varnishes, and Lacquer Technology*.

Basic principles of the manufacture, formulation, and application of paint, varnish, lacquer, and other organic coatings will be covered. Representative topics include: raw materials used for organic coatings—pigments, resins, oils, driers, solvents, lacquer raw materials, rubber based products; formulation of organic coatings—industrial, trade sales, architectural, maintenance coatings. Given on Wednesday, 6:15—8, February 8—May 31, the course will be given at New York University, Division of General Education and Extension Services, Washington Square, New York 3, N. Y. Fee is \$45.00.

Standard to Expand

A new complex of chemical plants, to cost nearly \$17 million, will be started soon at the Richmond refinery of Standard Oil Co. of California, it was announced by California Chemical Co., Standard's chemical subsidiary.

The new complex will produce enough para xylene to increase Richmond's annual output by 41 million pounds and will also provide more than 100 million pounds per year of high purity ortho xylene.

Construction is expected to be completed late in 1961 or early the following year.

Porter Paint Subsidiary Builds New Eastern Plant

Construction of a new eastern paint plant, at North Brunswick, N. J. was announced by Patterson-Sargent Co., Cleveland-based subsidiary of H. K. Porter Co., Inc.

The new, one story plant, occupying approximately 44,000 square feet, will house the most modern paint manufacturing, packaging and materials handling equipment.

Goodyear Joins Paint Industry

Entry into a new area of the paint industry has been announced by the Chemical division of The Goodyear Tire & Rubber Co. with the introduction of a soluble, acrylic-based paint resin.

The new material, "Pliolite AC," is a lacquer or air-drying type resin with excellent resistance to ultraviolet rays of sunlight.

Produced in granular form, it is a versatile material that processes easily and exhibits good resistance to heat, water, abrasion and outdoor exposure.

Enamels, semi-gloss, flat and clear coatings based on the new product hold up exceptionally well against the effects of acids, alkalies, and various oils.

Resin is compatible with a large variety of other paint materials, opening up many new areas of application.

Prolonged tests in Florida have shown that Pliolite AC finishes have unusual resistance to discoloration and chaling caused by exposure to ultraviolet rays of natural sunlight, the company reports.

Patterson-Sargent Builds New Eastern Plant

Construction of a new eastern paint plant, at North Brunswick, N. J., was announced by The Patterson-Sargent Co., Cleveland-based subsidiary of H. K. Porter Co., Inc.

The new North Brunswick plant will produce a full line of paints and other finishes for residential, commercial, industrial and marine use.

Monsanto Phthalic Plant Contract Goes to Badger

A contract for the design, engineering and construction of Monsanto's recently announced phthalic anhydride plant has been awarded to the Badger Manufacturing Co., Cambridge, Mass.

The proposed Monsanto Chemical Co. plant will employ the Sherwin-Williams fluid bed catalytic process which is licensed exclusively through Badger. This improved process, in contrast to the more conventional fixed bed routes, offers close temperature control of the catalytic bed higher potential yield; excellent product purity, color and heat stability.

February 13-15. Spring meeting of Committee D-1 on Paint, Varnish, Lacquer and Related Products of the American Society for Testing Materials. Hotel Roanoke, Roanoke, Va.

February 23. Protective Coatings Div. of the Chemical Institute of Canada, Divisional Conference, Toronto, Ontario.

February 24. Protective Coatings Div. of the Chemical Institute of Canada, Divisional Conference, Montreal, Quebec.

March 15-18. Annual Convention of the Southern Society for Paint Technology. Atlanta Biltmore Hotel, Atlanta, Ga.

March 21-30. American Chemical Society National Meeting, St. Louis, Mo.

May 5-6. Southwestern Paint Convention of the Dallas and Houston Societies for Paint Technology, Houston, Tex.

May 18-20. Southwestern Paint Convention of the Dallas and Houston Societies for Paint Technology, Houston, Tex.

May 26-27. Fourteenth Annual Spring Symposium of The Pacific Northwest Paint & Varnish Production Club. Hotel Georgia, Vancouver, B. C.

June 2-3. Annual joint meeting of the Kansas City and St. Louis Societies for Paint Technology, Kansas City, Mo.

June 5-9. Plastics Exposition Sponsored by the Society of the Plastics Industry, New York Coliseum.

June 20-27. 6th Paint Short Course for High School Chemistry Teachers, University of Missouri School of Mines and Metallurgy, Rolla, Mo.

November 26-28. Fourteenth Annual Convention and Trade Show of the Retail Paint & Wallpaper Distributors of America at Cobo Hall, Detroit, Mich.

December 4-6. Chemical Specialties Mfrs. Assn., 48th Annual Meeting, New York City.

NEWS

Pigment Club Hears Talk "Silicas in Coatings"

Sidney B. Levinson, Vice-President and Technical Director of the D. H. Litter Co. Inc., and the David Litter Laboratories was the guest speaker at the December meeting of the New York Pigment Club.

Mr. Levinson addressed the 52 members and guests on the subject of "Silicas in Coatings." This



Sidney B. Levinson

was an interesting topic for this group since most, if not all, of the members of the club deal with pigments which are either opaque or colored or both. Yet silicas are neither, in fact two of their very desirable features are their very lack of both opacity and color.

The various types of silicas, both natural and synthetic were described. Then the speaker pointed out the extreme range in physical properties and cost. Some of the newer, highly efficient types actually are more expensive than all the so-called prime or opaque white pigments and most colored pigments.

Mr. Levinson then used charts and graphs to demonstrate the wide variation in performance properties of the various types of Silica with particular reference to viscosity, thixotropy, flattening efficiency and abrasion resistance. He demonstrated that in some cases the relatively expensive grades are so highly efficient that the cost

of the finished costing is not as high as might be expected. The synthetic types in particular are most useful in producing gel coats of polyester or vinyl organosols, in the flattening of furniture varnishes and lacquers.

The consensus of opinion of the audience was that Mr. Levinson's talk proved that some "extenders" can be extremely effective and do perform highly desirable functions in coatings other than producing either color or opacity.

Rutgers Offers Course

William Lawrence, Technical Editor of *Paint Industry Magazine* and supervisor of the Pigment Laboratory of Ciba Co., Inc., will instruct the Advanced Paint Technology course being offered by the Rutgers Newark Extension Center in its new term starting January 30.

While early registration is advised because of limited class accommodations, Extension Center students are permitted to enroll as late as the week of February 6 for adult classes.

The Advanced Paint Technology course is scheduled on Monday evenings from 8:15 to 10:05, the first session being January 30.

According to Mr. Lawrence, the instruction will feature the latest developments in special oils, varnishes, and alkyds, the new types and use of pigments (white, colored, and extenders), and the latest methods of pigment dispersion.

In addition, Mr. Lawrence will cover the use of epons, vinyls, silicones, and urethanes; rheology; preparation of emulsions and use of surfactants; formulation principles of architectural coatings; lacquer and specialty finishes; and surface preparation and finishing methods.

Registration information and details concerning this Advanced Paint Technology course may be secured at the office of the Newark Extension Center, Rutgers-The State University, 601 Broad St., Newark, afternoons and evenings through Friday, January 27.

New Facilities Announced For Tolyene Diisocyanate

Plans to construct additional facilities for the manufacture of tolylene diisocyanate have been approved by the board of directors of Mobay Chemical Co.



Constituent Society Meetings

- Baltimore**, 2nd Friday, Marty's Park Plaza Hotel.
- Chicago**, 1st Monday, Furniture Mart.
- C.D.I.C.**, 2nd Monday.
- Cincinnati** — Oct., Dec., Mar., May, Dick Perfidio's Wishing Well.
- Dayton** — Nov., Feb., April, Hotel Gibbons.
- Columbus** — Jan., June, Sept., Everglades.
- Cleveland**, 3rd Friday, Cleveland Engineering & Scientific Center.
- Dallas**, 1st Thursday after 2nd Tuesday, Lucas B & B.
- Detroit**, 4th Tuesday, Rackham Building.
- Golden Gate**, Monday before 3rd Wednesday, Sabella's Restaurant, San Francisco.
- Houston**, Monday prior to 2nd Tuesday, Rams Club.
- Kansas City**, 2nd Thursday, Pickwick Hotel.
- Los Angeles**, 2nd Wednesday, Montebello Country Club.
- Louisville**, 3rd Wednesday, Sheraton Hotel.
- Montreal**, 1st Wednesday, Queen's Hotel.
- New England**, 3rd Thursday, University Club, Boston.
- New York**, 1st Thursday, Brass Rail, 100 Park Ave.
- Northwestern**, 1st Friday, St. Paul Town and Country Club.
- Pacific Northwest**, 3rd Thursday, Washington Athletic Club, Seattle, Wash.
- Philadelphia**, 2nd Thursday, Philadelphia Rifle Club.
- Piedmont**, 3rd Wednesday, Rainbow Supper Club, High Point, N. C.
- Pittsburgh**, 1st Monday, Gateway Plaza, Bldg. 2.
- Rocky Mountain**, 2nd Monday, Republican Club, Denver, Colo.
- St. Louis**, 3rd Tuesday, Rugger's.
- Southern**, Annual Meetings Only.
- Toronto**, 3rd Monday, Oak Room, Union Station.
- Western New York**, 1st Monday, 40-8 Club, Buffalo.

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Arctic Lodge	84	Herman Hockmeyer & Co.	77	Rohm & Haas Co.	6
Arizona Chemical Co.	18	J. M. Huber Corp.	80	Chas. Ross & Son Co., Inc.	Jan.
Atlas Electric Devices Co.	70	Imperial Color Chemical & Paper, Pigment Color Div., A Dept. of Hercules Powder Co., Inc.	Jan.	St. Joseph Lead Co.	Jan.
Baker Castor Oil Co., Subs. of National Lead Co.	16	O. G. Innes Corp.	64	Shawinigan Resins Corp.	53
The Buhler Corp.	60	Instrument Development Laboratories, Inc.	95	Shell Chemical Co.	3
Burgess Pigment Co.	82	International Talc Co.	14	Signal Oil & Gas Co., Houston Div.	76
California Ink Co.	72, 73	Johns-Manville Corp.	46	Sinclair Petrochemicals, Inc.	Jan.
Carbola Chemical Co.	17	Kentucky Color & Chemical Co., Subs. of Harshaw Chemical Co.	Jan.	Skelly Oil Co., Industrial Div.	Jan.
Carbide, Inc.	20	Karl Kiefer Machine Co.	86	Southern Clays, Inc.	Jan.
Celanese Corp. of Amer., Chemical Div.	Jan.	Kinetic Dispersion Corp., Inc.	Jan.	Spencer Kellogg & Sons, Inc.	37
Ciba Products, Inc.	93	H. Kohnstamm & Co., Inc.	Jan.	Sprayon Products, Inc.	72
Columbian Carbon Co.	11, 79	J. M. Lehmann Co., Inc.	69	Titanium Pigment Corp., Subs. of National Lead Co.	54
Commercial Solvents Corp.	43	McDaniel Refractory Porcelain Co.	71	Troy Chemical Co.	Jan.
Coors Porcelain Co.	65	Mearl Corp.	Jan.	Union Carbide Chemicals Co., Div. of Union Carbide Corp.	58
Davies Can Co.	Jan.	Minerals & Chemicals Philipp Corp.	75	Union Carbide Plastics Co., Div. of Union Carbide Corp.	12, 13
J. H. Day Co.	9	Minnesota Linseed Oil Co., Subs. of National Lead Co.	Jan.	U. S. Hoffman Can Corp.	92
Dianol Div., Mills-Pearson Corp.	99	Morehouse-Cowles, Inc.	Jan.	U. S. Stoneware Co.	62
Dicalite Dept., Great Lakes Carbon Corp.	Jan.	National Lead Co.	Jan.	R. T. Vanderbilt Co.	Jan.
Dow Corning Corp.	24	National Starch & Chemical Corp.	56, 57	Velsicol Chemical Corp.	19
DuPont de Nemours & Co., Inc., E. I., Explosives Dept.	Jan.	New Jersey Zinc Co.	59	Vulcan Steel Container Co.	4th Cover
The Eagle-Picher Co.	81			John Wiley & Sons, Inc.	Jan.
Eastman Chemical Products, Inc.	8, 39			C. K. Williams & Co.	Jan.
Elgin Mfg. Co.	78				
Emery Industries, Inc.	22				
English Mica Co.	96				

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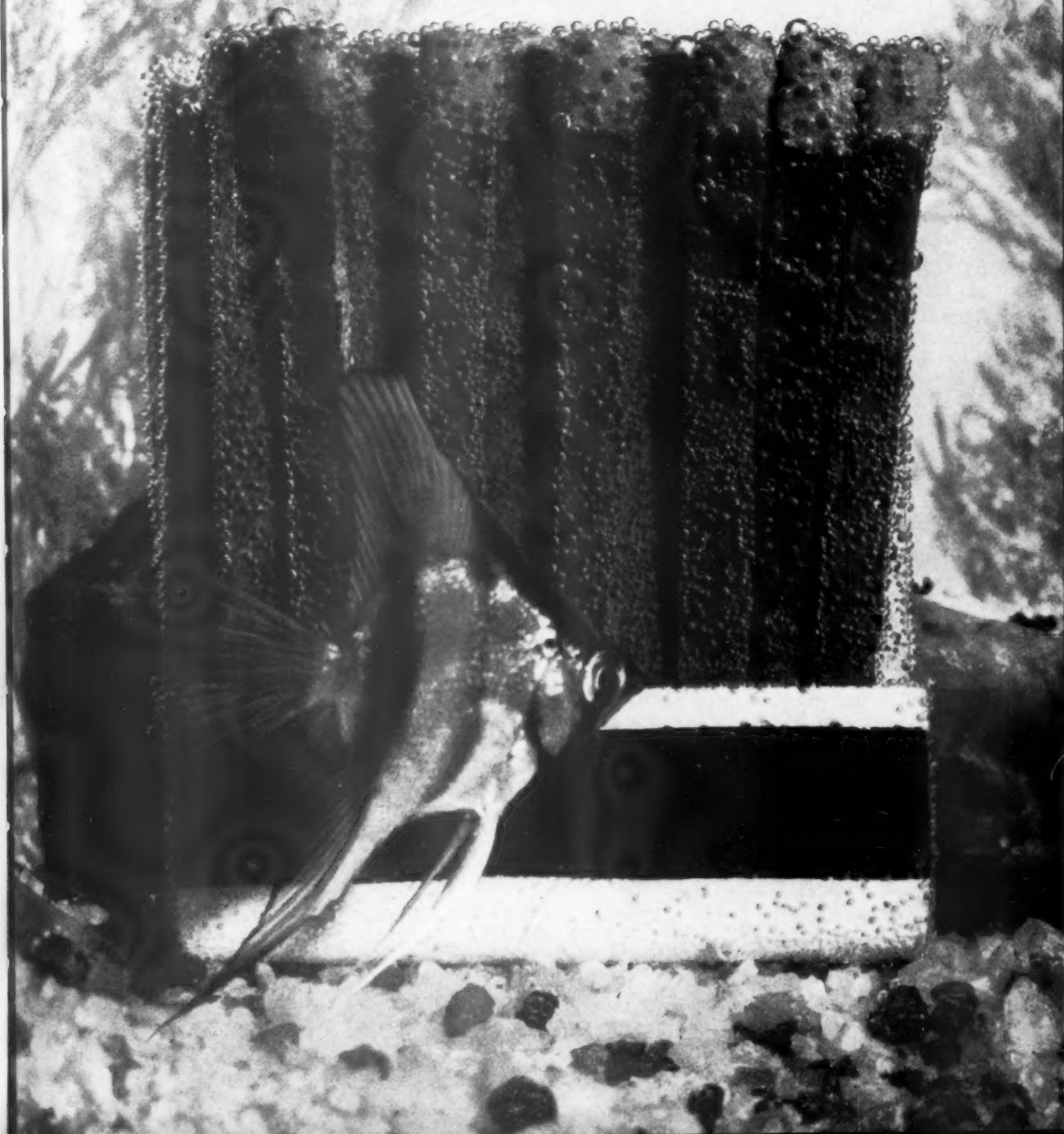
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